554

SCIENTIFIC LIBRARY

UNITED STATES PATENT OFFICE

GOVERNMENT PRINTING OFFICE 11—8625

TK
1
.P7

Z 9369

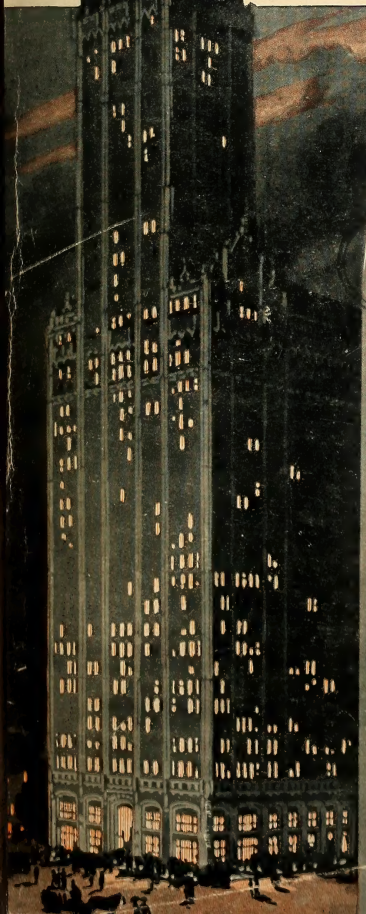
AUGUST

15 CENTS

Popular Electricity Magazine

PUBLIC SERVICE TECHNICAL LIBRARY
NEWARK, N. J.

LIBRARY
SEP 21 1931
U. S. PATENT OFFICE

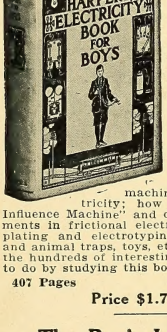


Electrical Books for Boys

IF Thomas A. Edison could have obtained books of this kind when he was a newsboy on the Grand Trunk Railway he would have devoured them with great eagerness, but very little was known of electricity at that time, or of the many ways in which it is now utilized in our every-day life. However, we have not accomplished all that is to be done and it is therefore essential that the wide-awake boy equip himself with a knowledge of the principles and present day applications of this great force by reading the books now obtainable.

These books present the subject in a manner that will furnish both interesting and instructive reading for boys of all ages.

Electricity Book for Boys



By J. H. ADAMS

This is a book that the boy will eagerly devour. Shows him what he can do with his own hands and how he can accomplish results with inexpensive materials.

Explains briefly and in simple language the working of electricity in its daily application and has an appendix of electrical terms and phrases.

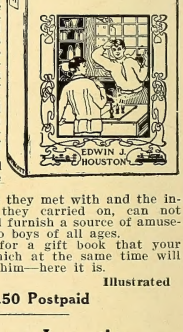
How to make simple batteries, horse shoe magnets, induction coils, burglar alarms, push buttons, electrical buzzers, bells and horns, electric alarm clocks, telephones, telegraph and "wireless" apparatus, dynamos and motors; how to run a sewing machine, fans and toys by electricity; how to make a "Wimshurst Influence Machine" and conduct interesting experiments in frictional electricity; how to do electroplating and electrotyping, make electrical insect and animal traps, toys, etc. These are but a few of the hundreds of interesting things a boy may learn to do by studying this book.

407 Pages **274 Illustrations**

Price $1.75 Postpaid

The Boy Electrician

By E. J. HOUSTON



Any boy who can read this book and not become absorbed in its contents must lack those peculiar qualities which go into the make-up of a real live boy. It is a story full of fun and adventures of two bright boys who possessed marked scientific powers in addition to their fondness for baseball, swimming, and other sports, and who managed to learn a great deal about electricity while having lots of fun.

The remarkable and quaint doings of the "Jolly Philosophers," the exciting adventures they met with and the interesting experiments they carried on, can not fail to be attractive and furnish a source of amusement and instruction to boys of all ages.

If you are looking for a gift book that your boy will enjoy, and which at the same time will prove of real value to him—here it is.

326 Pages **Illustrated**

Price $1.50 Postpaid

The Boy's Life of Edison

By Wm. H. Meadowcroft

It is probably as a worker of wonders, an actual wizard of science, that Edison fascinates the imagination of almost every boy. In this picture of the real facts of the inventor's life from his early boyhood up to the present time, the reader will find that while Edison is just as great as imagined, yet this greatness has not been reached by chance, but honestly earned by the hardest kind of hard work. The wonderful things that he has accomplished have been the things that he purposely set out to do, and are not the result of some happy thought or chance. Each page has been read by Mr. Edison and he has given it his personal endorsement. Every boy should read it.

331 Pages **Fully Illustrated**

Price $1.25 Postpaid

Story of Great Inventions

By Elmer E. Burns

The purpose of this book is to tell in simple language how our great inventions came into being, to depict the life-struggles of the men who made them and in the telling of the story, to explain the working of the inventions in a way the boy can understand.

The stories are so woven together as to give the young reader a connected view of how our great inventions have arisen out of scientific discovery on the one hand and social and economic conditions on the other.

This well written romance of great inventors will appeal strongly to young readers as well as to many older ones.

249 Pages **Fully Illustrated**

Price $1.25 Postpaid

POPULAR ELECTRICITY BOOK DEPT., 54 West Lake St., Chicago, Ill.

Popular Electricity Magazine

Volume V

Issues May, 1912, to April, 1913

LIBRARY
29369
SEP 21 1931
U. S. PATENT OFFICE

INDEX

A

	Page
Absorption in X-Ray Tubes	351
Achievement, A Matter of	886
Acousticon, The Invention of the	355
Across the Alps by Electric Auto	1122
Adaptable Lamp Stand	694
Adapter, A Pull Chain	426
Adapting the X-Ray to Minor Surgery	169
Adding Charm to the Picture	929
Adjustable Reflector	693
Adjustable Table, Paper Drill with	695
Adjustable Water Rheostat	291
Adjustable Work Bench Fixture	734
Adjuster, A New Cord	159
Adjuster, An Approved Lamp Cord	266
Adjuster, Cord	489, 1136
Adjuster for the Drawing Table, Light	89
Adjuster, Lamp	458
Adjuster, Magna Lamp	694
Advantage of Electric Cooking, An	70
Advertisement, Hat Cleaner's	986
Advertisement, Ingenius	825
Advertisement on Lamp Globe	985
Advertises Electric, Mammoth Bouquet	770
Advertising, Aeronautic	1349
Advertising Device, Corn Cure	449
Advertising in Baltimore, Novel Searchlight	420
Advertising in Clock Case, Electric	984
Advertising in Shanghai, Electric	1182
Advertising in Waste Space	1245
Advertising, Outdoor Electric	445
Advertising, Religion	53
Advice to Freshmen	326
Advice to Prospective Wireless Operators	379
Aerial Bridge in Miniature, The	984
Aerial Car, Lineman's	1303
Aerial, Novel Method of Suspending	384
Aerial Trams of a Utah Mine	254
Aerials for Wireless, Low	1252
Aeronautic Advertising	1349
Aeroplane Designing for Amateurs (Book Review)	505
Aeroplane Phonograph	1017
Aeroplane Propeller Operates Window Display	98
Aeroplane Roundabout	541
Aeroplane Wireless Experiments in France	1096
Aeroplanes, Bird	23
Aeroplanes, Wireless Telegraphy on	393
African Power Project Near Completion, Huge	1280
Aging Cheese Electrically	202
Aids to Navigation on the Panama Canal	938
Aids to the Partially Deaf	125
Aiming and Firing a Heavy Gun	1223
Aiming Device, Searchlight	884
Air, Collecting Static Electricity From the	245
Air for Dynamos, Filtering	167
Air Humidifier for Mines	1134
Air in Telephone Vault, Providing Pure	463
Air Pump from Bicycle Pump, Laboratory	1350
Air, Radium in the	337
Air Surveys, Movable Laboratory for	925
Airship, Trolley Wires for	245
Airships, Wireless from	203
Airships, Wireless on German	591
Aladdin's Lamp, Electro-Magnet a Veritable	455
Alarm, A Simple Door Bell	95
Alarm Circuit, Service Switch Closes Burglar	731
Alarm Contacts, Door and Window	983
Alarm, Door	710
Alarm for Boats, Leakage	91
Alarm for Telephone Systems, A General	1024
Alarm, Home-made Cash Drawer	295
Alarm, Ice Box Drip Pan	732
Alarm, Mail Box	980
Alarm, Mine	693
Alarm, Open Door	729
Alarm, The Phonograph as an Automobile	315
Alarm, Tool Chest Lock and	976
Alarm Switch, Fire and Burglar	266
Aldershot Experiments, English Royalty at the	335
Alexander Graham Bell	245, 340, 1049
Alexander Wireless Bill	592
All-British Cable to Canada	301
Alley Pole Lines	518
Alpine Scenery, How the Swiss Exploit Their	1165
Alps, A New Road Over the	620
Alps by Electric Auto, Across the	1122
Aluminum, Electric Cars of	203
Aluminum, Electro-Plating	1278
Aluminum Powder, Coating Balloons with	394
Amateur Radio-Operation, Regulation of	286
Amateur Wireman, For the	201
Ambition	242
Ambrose Channel Lightship, The	75
American and English Telephone Operators Compared, Promptness of	264
American Boy Sees Switzerland, As an	708
American Conventions, Foreign Delegates at	684
American Equipment in Japanese Mines	915
American Lamps Superior	340
American Museum of Safety Medals, Award of	1270
American Steel and Wire Company	1188
American Tourists, Electricity to Attract	784
Ammeter, A Simple	373
Ammeter, Unique	837
Ampere Hour Meter for Electrics	566
Amputation by Wireless Instructions	301
Anchor for Entrance Wires	199
Ancient Industry Electrified, An	209
Ancient to Modern Water Wheels, From	344
Andes, Strange Light from the	1015
And Their Friends Were Led to It	1226
And Then the Turks Began to Fight	1071
Animal Hospital	1174
Animals, Electrocution of Superfluous	1069
Animals, Humane Destruction of	1286
Anniversary of Electric Lighting in New York, Thirtieth	680
Announcing Subway Trains	527
Annunciator and Bell	75
Annunciator, Extension Bells for	490

	Page
Annunciator for Limousines, Auristophone	360
Annunciator at a Water Carnival, Automatic	546
Antarctic, Wireless in the	874
Antenna for Balloons, Wireless	718
Antipodes, Extremes Meet in the	1035
Anti-Window-Stare, The	986
A Parliament Building	832
April Shower, An	1338
Arabia, Electric Lighting in	711
Arc and Incandescent Lights	114
Arc Carbons Made From Tar	995
Archie Rice, A New Series by	101
Archimedes Tower, An	1224
Arc Lamp, Cut-Out Hanger for	691
Arc Lamps, Ornamental Luminous	543
Arc Light, The Golden	928
Arc Lights and High Class Photography	1040
Arc, Temperature of the	789
Argentine Battleship, Rivadavia—The Great	1149
Ariston	56
Arlington, Navy Wireless Station at	190
Arlington Towers, The Great	1065
Armatures, Truck Handling	491
Army Repair Shop on Wheels	1031
Arrival of the First Chauffeuse, The	256
Art, Illumination of Works of	275
Art Institute, Chicago, Indirect Illumination in the	275
Art, Lighting as an	755
Art of the Housewife, The	1081
Articulated Trolley Car, Boston's	1292
Artificial Aurora, An	798
Artificial Light on Hangings, Effects of	953
Artificial Rubber	298
Artificially Lighted Rows	988
Artistic Electric Candlesticks	70
Artistic Rest Stations in Pasadena	444
Artistic Work, A Woman's	464
Asbestos Production Doubled, United States	152
Astronomers, Heated Coat for	1290
Athletes, X-Ray in Studying	343
Atlantic Weather Bureau, Proposed	715
Atmospheric Electricity	492
Atom, Pursuit of the Nitrogen	1035
Attracting the Isaac Waltons	296
Audible and Visible Signal	1324
Audiffren Refrigerating Machine	457
Auait Machine, Men Wonder at New	564
Auristophone Annunciator for Limousines	360
Aurora, An Artificial	798
Australia, Coal Mining Machines in	922
Austria-Hungary, Manojlovac Plant in	220
Auto Drivers, Heated Glove for	932
Auto Gas Headlights, Lighter for	729
Auto, One of the Nobility and His Electric	374
Auto-Rotor	297
Auto Tire, The Rolling	496
Auto Trucks, Demonstrating Gasoline	736
Auto-Electric Refrigerating Machine	372
Autobiography of a Fan, The	368
Autocall	19
Automatic Annunciators at a Water Carnival	546
Automatic Compasses for Ships	1186
Automatic Demagnetizer, Green	197
Automatic Electric Cook Stove	174
Automatic Electric Generator for Country Homes	1257
Automatic Switch, Electro-Magnet with	198
Automatic Table Waiter, An	788
Automatic Tell-Tale System, Ship	362
Automatic Temperature Regulator	164
Automatic Tunnel Lights	1279
Automatic Typewriter	1000
Automatic Weighing Machine	361
Automatic Wheelsman, An	135
Automaton, The Speaking	795
Automobile Alarm, The Phonograph as an	315
Automobile Door Lighting Switch	1269
Automobile, Electric	936
Automobile Electric Starter	1132
Automobile Garage	1014
Automobile Has Arrived, The Pullman	771
Automobile Horn for Factory Signal	494
Automobile, Record Run of	41
Automobile Searchlight, French	1064
Automobile Self-Starter	1001
Automobile, Self-Starting Gasoline-Electric	540
Automobile Signal Board	789
Automobile Step Light	819
Automobile Tire Pump	1259
Avalon Wireless Station	185
Award of American Museum of Stafety Medals	1270

B

	Page
Babies, Electric Stimulation for	310
Baby, A Trolley Cradle for the	68
Baby by Telephone, Tending	805
Baby Cribs, Electrical Warmers for	441
Baby Jumbo's Heart Beats	407
Baby Spark Coil	57
Baby's Comfort, Electricity Adds to	372
Badgers with a Searchlight, Frightening	159
Bad Lands, Cheap Fuel of the	509
Bakelite	875
Baker's Window, Fly Chaser for the	936
Balance Sheet	1375
Balkan War, Wireless in the	1124
Balky Horse, Electric Starter for	1086
Ball Bearings on Electric Cars	534
Ball Games, Loud Speaking Telephone at	935
Ballet, Trolley Wire Fires Captive	1290
Balloons, Wireless Antenna for	986
Balloons with Aluminum Powder, Coating	394
Baltimore, Novel Searchlight Advertising in	420
Bank Lighting Hints	491
Bank Vault, Laundry in a	57
Baptismal Fount, Electrically Heated	932
Barbados, Laying Cables in	1077
Barbarians of Formosa, Surprising the	218
Barber Pole as a Lamp Post	1245
Barber Pole, The Rotating	100
Barges on the Missouri, Pumping	33
Barrels, Ozone for Sterilizing	996
Baseball Pitchers, Speed Tests of	1090
Baseball Score Board	584
Basket of Glow Lamps	497
Bastile Column, Lighting the	1182
Bates, Onward	810
Bathers, Hotel for Radium	408
Baths in Bohemia, Radium	69
Batiken Color Designs	1344
Batter, A Boiling	244
Battery Around, Kicking That	39
Battery Box	1373
Battery, Buff Cochins and the	706
Battery Charging	339, 439
Battery Charging Outfit, Unique	374
Battery Cigar Lighter	818
Battery, Danish Professor's New	508
Battery Holder	390
Battery in a Cake of Ice, Storage	926
Battery, Lead Pipe Storage	585
Battery Locomotive	1
Battery Plant, Strange, Electric	756
Battery Switch	1258
Battery Tester, A Convenient	865
Battery Voltmeter, A Pocket Storage	94
Battery Wound Clock	1131
Battleship and Her Electrical Equipment, The World's Greatest	1292
Battleship, Rivadavia—The Great Argentine	1149
Bavaria, Peat Fields of	394
Bearded Grain Draws Electricity from the Air	1253
Bears' Dens, Electric Radiators in	111
Beauty Parlor	64
Bed Blanket, Ideal	1082
Bed, Light Fixtures on	297
Bed Warmer	1362
Beecham Comments on English Electrical Affairs, Sir Joseph	660
Behind the "Scenes" in a Moving Picture Theatre	1036
Bell Alarm, A Simple Door	95
Bell, Alexander Graham	245, 340, 1049
Bell and Annunciator	75
Bell, A Test	857
Bell Attachment for Dart Board, Electric	183
Bell by "Wire," Division	490
Bell Circuits and Their Installations, Electric	602
Bell, Motor Operated	197
Bell, Office	1241
Bell Ringing Transformer	820

Page

Bell System Proof Against Fire-damp... 1380
Bell, Telephone Extension..... 1199
Bell that Strikes the Hours..... 975
Bells Electrically Tolled, Famous Church 618
Bells for Annunciator, Extension..... 490
Bells Rung by the Sun, Electric..... 1295
Bench Fixture, Adjustable Work..... 734
Bergonie's Apparatus 1325
Begonie High Frequency Treatment.... 1160
Berlin, Electric Taxis in..... 101
Berlin, Immense Electrification Project for 258
Besmirching the Skies..... 907
Bicycle Pump, Laboratory Air Pump from 1350
Biggest Thawout on Record, The..... 36
Billboard Lighting, Effective Night..... 694
Bioscope Electrician's Handbook, The (Book Review) 505
Bird Aeroplanes 23
Birds and the Wireless..... 957
Birds, Electric Light for..... 841
Birds, Photographing 858
Birds, Short Circuits Powerful..... 1225
Black Art Entertainment, A..... 677
Blacksmith, Light for the..... 96
Blacksmith Shop, Fan in..... 1043
Blanket, An Ideal Bed..... 1082
Blast Firing with Wireless..... 1122
Blind, Moving Pictures for the..... 796
Blood, Jr., William H..... 123
Blooms by Lamp Light, A Window of... 66
Blower, A Forge..... 1003
Blue Bird, The..... 946
Blue-Print Machine, A..... 928
Blue-Print Machine, English..... 1008
Blue Room Mystery, The..... 1280
Boat, Electric Propulsion for Lake..... 656
Boat No. 2, Chicago's New Police Patrol. 557
Boat, The Electric Swan..... 343
Boats Compelled to Carry Wireless, Canadian 1357
Boats Equipped with Wireless, Holland Fishing 393
Boats, Leakage Alarm for..... 91
Boats Propelled by Electricity, Canal... 687
Boats, Telephone in Pleasure Motor..... 22
Boats, Wireless on Ferry..... 506
Boats, Wireless on Fishing..... 190
Boats, Wireless Outfits for Small..... 283
Body, Vibrating the Whole..... 927
Bohemia, Radium Baths in..... 69
Boiler and Turbine Wheel, Electric..... 278
"Boiling Battery," A 244
Boiling Water in a Hurry..... 165
Bonds as an Investment..... 1121
Bonds on Installment Plan, Buying Stock and 1250
Bonds Showing Income Yield, List of 1249, 1377
Bond Tester, The..... 1258
Bone Structure, X-Ray in Observing.... 559
Book Holder, Telephone..... 1303
Book of Mystery..... 981
Books by Electricity, Photographing.... 260
Booth, Ventilated Telephone..... 927
Bouquet Advertises Electric, Mammoth. 770
Borers, Magnetized 1087
Boron in Cast Copper..... 449
Boston "Tech" Library, Vail Gift to..... 509
Boston, The New Cambridge Subway of. 160
Boston's Articulated Trolley Car..... 1292
Bothersome Ohms, The..... 1285
Bottle Warmer, Spray..... 1136
Bourseul, Charles 1168
Box Cars Loaded by Motor..... 1285
Boxes, The Tumbler..... 1112
Boxing and Connecting Dry Cells..... 1372
Boys Advertise Electricity, Indian..... 587
Boy Scouts Studying Wireless, English. 382
Boy Sees Switzerland, As an American.. 708
Bracket, Handy Lamp..... 61
Brain a Telephone Exchange..... 565
Brain versus Brawn..... 1002
Brake Attachment for Sewing Machines, Motor and 1373
Brake, Phonograph with Electric..... 255
Brandy and Champagne, Electricity 1114
Brass for Fixtures is Made, How..... 1242
Brazil, An Electro-Sanitation Plant in.. 1177
Brazilian Wireless System Great..... 718
Brazing and Soldering (Book Review).. 300
"Break-in" System 384
Breaking in Shoes, Apparatus for..... 259
Breezes by Wire, Mountain..... 470

Page

Bridge in Miniature, The Aerial..... 984
Bridge, Paddle Wheels Open and Close.. 519
Bridget's Change of Heart..... 68
Bright Future for Electric Power in Ireland 1288
Brine Saving Device..... 292
British Battleships, Floating Dry Dock for 767
British Government, Marconi Contract with 298
British Soldiers Using Wireless..... 843
Brobignag and Lilliputian..... 1044
Broiling by Electricity..... 829
Broiling in the Engineers' Club, Electric 1061
Brooder and Incubator, Electric..... 1181
Brooklyn Navy Yard Wireless Training Station 478
Brook, Running a Farm by the Power of 1058
Browntail and Gypsy Moths, Destroying the 669
Brush, A Trade Winning Shoe..... 734
Brush Discharge, The..... 1100
Brush, Matthew C..... 168
Brushes, Care of Commutator and..... 862
Burners on Electric Railways, Weed..... 805
Bush Land, A Plant in the..... 944
Butchers, Meat Slicing Machine for..... 1003
Building the Trolley in the Remote Places of the Earth..... 1144
Building at Panama-Pacific Exposition, Electricity 1180
Bulbs, Chemical Flasks from Electric... 181
Butterfly Exhibit 498
Buzz Saw, The Magic..... 475
Burglar Alarm Switch, Fire and..... 266
Bulbs and Reflectors, Cleaning of..... 72
Buried Alive 40
Business Methods Good for the Home... 71
Burglar Alarm Circuit, Service Switch Closes 731
Bubbles, Moving Pictures of..... 786
Buenos Aires, Illuminated Gardens in... 325
Bust of Lord Kelvin, Presentation of.... 340
Buds from Frost, Tree Vibration for Saving 528
Buttons, Illuminated Vest..... 572
Buff Cushins and the Battery..... 706
Buildings, Supporting Open Wiring in Concrete 730

C

Cable, Counter Weight..... 124
Cable, Fishing Up a..... 1227
Cable in the English Channel, Laying Telephone 112
Cable Incline in the Tyrol..... 813
Cable Laying in Barbados..... 1077
Cable Splicing on Snow Shoes..... 1057
Cable Splicer at Work, The..... 521
Cable Station in Mid-Pacific, A Lonely.. 316
Cable, Termites Destroy a..... 1303
Cable to Canada, All-British..... 301
Cables, Drying Telephone..... 1241
Cables, Gray Squirrels Gnaw..... 251
Cables in Japan, Laying Lighting..... 534
Cables, Putting the Lead Sheaths on.... 1068
Cables with the Telafault, Exploring.... 12
Cabot's Physician's Electric..... 691
Cabinet, Service Kitchen..... 271
Cabinet, Tapping Individual Lights from the Switch 732
Cadillaqua, Detroit's Beautiful Water Festival 544
Cafes, The Lighting of..... 1084
California, Electric Smelter Plant in.... 1304
California, Hydro-Electric Wonders in.....2, 227, 320, 434
California Rain Maker, A..... 958
Call System, Police..... 1201
Call Bell, Return Call Button Hides..... 268
Call-Letters, New Wireless..... 483
Caller Is at Which Door..... 75
Cambridge Subway of Boston, The New. 160
Camellia Thea and the Modern Tea Room 366
Cameragraph, The 260
Canada, All-British Cable to..... 301
Canada, Nine New Wireless Stations for. 1232
Canadian Boats Compelled to Carry Wireless 1357
Canadian Farmers use Niagara Power.. 1161
Canadian Pacific, Telephone Dispatching on the 1322

Page

Canal Boats Propelled by Electricity.... 687
Candle, A German Electric..... 812
Candle, The Flexalite..... 461
Candle, The International..... 1260
Candlesticks, Artistic Electric..... 70
Candy Kettle in Window..... 97
Cane in Sugar Mills, Handling..... 167
Canoeing, Direction Returns, Efficient Plan for..... 646
Capacity of a Lifting Magnet..... 729
Capacity of Condensers..... 285
Captured Coffee..... 1218
Car, A German Wireless Motor..... 716
Car, Boston's Articulated Trolley..... 1292
Car Cleaning While on the Way..... 571
Car for Maintenance and Lamp Trimming, Electric..... 934
Car in France, A Funeral..... 909
Car Lights, Regulator for Street..... 128
Car Line, Chicago's Freak..... 1332
Car Location Board..... 1072
Car, Long Run of an Electric..... 920
Car System, Mouse Ties Up Street..... 527
Car, New York's Double-Deck Stateless.. 263
Car Ride, Longest Nickel Street..... 1279
Car, Startling Trailer for Electric..... 700
Car, Women Who Drive the Electric..... 1294
Carbon Boils, Where..... 87
Carbon Ends, Using Old..... 982
Carbon Holder for Lapping Machine, Improved..... 415
Carbon in Steel, Combustion Train Determines..... 1153
Carbon Lamp Electrodes, Mineralized..... 995
Carbons Made from Tar, Arc..... 664
Carborundum Furnace, The First..... 796
"Care and Operation of Automobiles" (Book Review)..... 875
Care of Commutator and Brushes..... 862
Carnival at Nice..... 350
Carnival, Automatic Annunciators at a Water..... 546
Carnival Crowd in Manila, Handling a.. 1227
Carnival, Illuminating a..... 49
Carnegie Schools Wireless Station..... 965
Cars, An Elevated Railway for Trolley.. 1309
Cars, Ball Bearings on Electric..... 534
Cars by Electric Power, Washing..... 1169
Cars Helped by Counter Weights..... 124
Cars Loaded by Motor, Box..... 1285
Cars of Aluminum, Electric..... 203
Cars on an Elevated Line, Surface..... 453
Cars, Street Indicator for Electric..... 926
Cars, Telephone for Motor..... 688
Carving of Stone Tablets, The..... 259
Cash Drawer Alarm, Home-made..... 295
Casings of Metal, Receiver..... 491
Casino Technical School for Women, The 144
Cast Copper, Boron in..... 449
Castle on a Trolley, A..... 899
Catalina Island, Wireless at..... 185
Cathode, How to Remember Which is the 378
Catskills, Bringing Water to New York from the..... 416
Causeway Across Galveston Bay, Great. 526
Ceiling Rosette..... 197
Cellar Light, Steps Turn Off..... 1363
Cells from Creeping, Preventing Oil in.. 391
Cells, Heat..... 1110
Cells, Photo-Electric..... 1112
Cement Dust, Electricity to Settle..... 1076
Centenary, The Faraday..... 1269
Central London Railway, Ozone in Tunnels of..... 1300
Central Point, Ore., Federal Wireless Station at..... 588
Central Station Business, College Men in the..... 1059
Central Station, Jumbo—A Relic of the World's First..... 1030
Central Station Plant, An Ideal..... 638
Central Station Power in Time of Strikes 203
Cent's Worth of Electricity, A..... 371
Cereal Cooker and Stove, Combination of 72
Chafing Dish Artists..... 1341
Chain Adapter, A Pull..... 426
Champagne, Electricity and..... 1114
Chandelier, A Wagon Wheel..... 67
Changing Song Slides..... 21
Character Determined by Machine, Mental..... 72
Charge on Rain, Electric..... 1294
Charged Conductors, Tension on the Surface of..... 1324

Page

Charged, Hotel That Is Electrically..... 42
Charles Bourseul, French Inventor of the Telephone..... 1168
Charles Proteus Steimetz..... 127
Chauffeuse, The Arrival of the First..... 256
Cheap Fuel of the Bad Lands..... 509
Cheap Mellow Light, A..... 201
Cheese Electrically Aging..... 202
Check System, A Telephone Credit..... 1173
Checker Game, Electrifying the..... 73
Checkerboard Table, Illuminated..... 75
Chemical Flasks from Electric Bulbs.... 181
Chemistry and Household Science..... 468
Chemistry, Euphonius..... 41
Chicago Schools, Wireless in..... 384
Chicago-New York Business Trip Without Going Out of Doors..... 22
Chicago's Freak Car Line..... 1332
Chicago's New Police Patrol Boat No. 2. 557
Chicken, Electric..... 246
Chickens, The White Way and the..... 944
Chicken Thief, Fooling the..... 74
Children, Electrical Treatment of..... 445
Children at Home, To Send..... 1045
Children, Safeguarding the Lives of Little..... 253
Children, Tesla's Plan of Treating..... 813
Children Visit Telephone Exchange, Deaf 472
China, Native Telegrams in..... 1087
Chinese Students Use American Telephone Methods..... 442
Chinese Noodle Makers, The..... 806
Chopping Bowl Reflector..... 981
Christmas Festival, The Illumination of the..... 830
Christmas Trees, Indoor..... 1177
Chuck, Magnetic..... 571
Church Bells Electrically Tolled, Famous 618
Church, Electric Cross for Historic..... 1308
Church Pews, Electric Heaters for..... 745
Church Spire, Electric Cone on..... 61
Cigar Demonstrator..... 818
Cigar Lighter Battery..... 574
Cigar, The Price of One..... 396
Cinematograph and Natural Science, The (Book Review)..... 731
Circuit, Service Switch Closes Burglar Alarm..... 602
Circuits and Their Installations, Electric Bell..... 386
Circuits, Electric Lighting..... 838
Circuit Railway, Washington 924
Circus-Museum Train, Electric..... 838
City of Toys, Down Rue de l'Etoile to the 1277
Cities, Safety from Lighting in..... 1294
Class Leaves Memorial, College..... 1208
Classes in Pulmotor Practice..... 72
Cleaning of Bulbs and Reflectors..... 1079
Cleaning Silver..... 1131
Clock, Battery Wound..... 984
Clock Case, Electric Advertising in..... 859
Clock Operated Time Switch..... 88
Clock Operates, How an Electrical..... 267
Clock, Reminder..... 1219
Clock That Needs No Winding..... 1088
Clock, The Only Earth Electrical..... 394
Clocks by Wireless, Setting Railroad... 241
Clocks, Hotel with 200 Electric..... 1356
Clocks in Tramcars, Electric..... 1273
Closed Core Transformer, Two Hundred Watt..... 1326
Cloth, Electricity Used in Dyeing..... 362
Clothes by Magnetism, Pressing..... 1357
Clubs Form Relay, New York..... 1273
Coal and X-Rays..... 1260
Coal, Electricity and Steam..... 679
Coal, Electricity and..... 773
Coal Equivalent of Niagara Falls..... 1331
Coal Field, Electric Power Drainage of a 91
Coal Fire, An Imitation..... 413
Coal Mines Turned Into Gas Reforts..... 922
Coal Mining Machines in Australia..... 922
Coal Output Doubles Every Ten Years.. 997
Coal, Public Unfamiliar with..... 111
Coal, White and Black..... 1159
Coal with X-Rays, Examining..... 618
Coat for Astronomers, Heated..... 1290
Coating Balloons with Aluminum Powder..... 394
Coating Metals with Lead..... 301
Cochins and the Battery, Buff..... 706
Code, Learning the Telegraph..... 280
Coffee, Captured..... 1218
Coffee Mill, A Swiss..... 265
Coil, Baby Spark..... 57

	Page
Coil Winder	1372
Coils, Experimenting with Large Induction	282
Coin Operated Photographing Machine	1135
Coin Operated Piano	56
Coke, From Diamond to	397
"Cold Light"	1059
Cold Storage Plant for Furs, A	674
Color Blending Top, A	798
Color Composition of Gas and Electric Lights	1031
Color Designs, Batiken	1344
Color Scheme Cookery	274
Colored Lacquer for Lamp Globes	1373
Colored Photographs Over the Wire, Sending	1254
Colors, Testing the Permanence of	866
Collapse of a Steel Transmission Tower	912
Collapsible Contact Maker	730
Collapsible Electric Light Holder and Stand	1133
Collecting Static Electricity From the Air	245
Collectors on Italian Cars, Odd Current	1324
College, How Electricity is Helping Me Through	374
College Class Memorial	1294
College Men in the Central Station Business	1059
College Prank, A	73
College Training of Electrical Engineers	446
Collision Preventer, Sir Hiram Maxim's	619
Colloids, Electrical	356
Columbia, Utilizing the Power of the	1310
Columbus and the Magnetic Needle	1087
Comb for Drying Hair, Electric	582
Combs Electrically, Heating	58
Combination Danger Signal, A	407
Combination Electric and Oil Lamp	996
Combination of Cereal Cooker and Stove	72
Combination Lamp for Photography	601
Combined Direct and Indirect Fixture	1243
Combined Fish Wire and Drill	1362
Combustion Train Determines Carbon in Steel	415
Combined Window Sign and Reflector	1322
Commutator and Brushes, Care of	862
Communication, Uncle Sam's Emergency Lines of	8
Communication Facilities, United States First in	621
Commercial Engineering for Central Stations (Book Review)	617
Commended for Telephone Enunciation	959
Compass, Magnetic Attraction and the	1323
Compass, Telefunken Wireless	1058
Compasses for Ships, Automatic	1186
Complexity of Telephone Field	439
Composition of Gas and Electric Lights, Color	1031
Concrete Buildings, Supporting Open Wiring in	730
Concrete Home, The Modern	1343
Concrete Poles Molded in Sections	1150
Condenser Formula, That	483
Condensers, Capacity of	285
Condenser, A Liquid	856
Condenser Water, Removal of Oil from	982
Conductor's Transformation, The	921
Conduit, A "Good Ending" in a	89
Conduits are Necessary in the Philippines, Why	654
Conduits, Ice Insulated	869
Conduit, New Use for	863
Coney Island, Electricity at	347
Congress of Electro-Culture, International	747
Conquest of the Pyrenees, Electric	771
Constantinople, Subways for	995
Construction of a 50 Watt Dynamo..854,	972
Construction of the 1915 Exposition Begun	1194
Contact Maker, Collapsible	730
Continental Types of Heaters	521
Contractor's Hoist, A Handy	267
Control for Steam Heating System	1371
Controlling Finger	1226
Conveniences in House Wiring	733
Convenient Fixture Control	93
Converter for Private Garages, Current	56
Converting Gas Fixtures to Electric	1370
Convict Inventor of Electrical Apparatus, Roy J. Meyers, the	241
Convicts See Moving Pictures	1092
Cook Stove, Automatic Electric	174
Cooker, Quad Electric Stove and Fireless	699
Cooker and Stove, Combination of Cereal	72
Cookery, Color Scheme	274
Cooking, An Advantage of Electric	70
Cooking, Electric	1080
Cooking, Fundamental Principle of Electric	72
Cooking in a Modern Hotel, Electric	704
Cooking in a Palace of India, Electric	1342
Cooking Reduces Shrinkage, Electric	470
Cooking Utensils, Electric	177
Copper, Boron in Cast	449
Copper Country, In the	790
Copper Refining in Norway, Electrolytic	937
Copper Refining Plant in Montana	1287
Cord Adjuster	489, 1136
Cord Adjuster, A New	159
Cord Adjuster, An Approved Lamp	266
Cord with Window Display, Harmonizing	100
Corn Cure Advertising Device	449
Corner for Effective Display Space, Utilizing an Out-of-the-Way	740
Cornwall, Smelting Tin at	256
Cozy-Glow, The	952
Cost of Living in France, The increased	1233
Cost of Operating Electric Irons	1345
Cost of Operation, Modern	320
Counter-Balance, Drop Light	733
Counter Weight Cable	124
Counting Laundered Currency	1272
Country Homes, Automatic Electric Generator for	1257
Cows in the Pasture, Milking	562
Cradle for the Baby, A Trolley	68
Crane, Giant Electric	1318
Crane in Gravel Handling, Power	897
Crane in Sugar Mills	167
Crane of Hamburg, The Great	873
Crane Service at a Way Station	1302
Crater, The Electric	1086
Creator and Destroyer, Electricity	657
Credit Check System, A Telephone	1173
Crescent Farms, Electricity At	913
Cribs, Electrical Warmers for Baby	441
Crookedest, Costliest Roulette Wheel, The	1327
Crops, Electrified Water Sprays To Encourage	1056
Crops, Electricity Moves Western Pumpkins	1275
Cross for Historic Church, Electric	1308
Crossarms After 43 Years, Telegraph	1071
Crossing Gate, Lamps on	431
Crystals, Apparatus for Forming Imitation	378
Cumulative Preferred Stock	1120
Cup Fixture Holder, Suction	1209
Cup is Empty, When the Oil	95
Curb, Lights Along the	1173
Curious Case of Electric Shock	923
Curious Electrical Effects in the Lake Tchad Region	874
Curious Fact as to Lightning	908
Curious Features of Lightning	857
Curious Uses of the X-Ray	1121
Currency, Counting Laundered	1272
Current Collectors on Italian Cars, Odd	1324
Current Converter for Private Garages	56
Current Distributing Insulator, Odd	1109
Current from Sunlight, Electric	299
Current, Novel Use of Electric	960
Current Rates Defined, Electric	686
Cut Glass Electrolier and Vase	933
Cut-Out Hanger for Arc Lamp	690
Cut-Out Switch, The	578
Cutter, Electric Meat	458
Cylindrical Lightning	956
Cypress Mill of the F. B. Williams Company, Patterson, La	334

D

	Page
Dam Roadway, Hydro-Electric Surmounted by a	824
Damming the Historic Rhone	607
Damp Places, Wiring	726
Dancing Doll, The	183
Danger Signal, A Combination	407
Danish Professor's New Battery	508
Dart Board, Electric Bell Attachment for	183
Date Industry, Electricity Aids the	150
Daughter of Heaven, The	1154
Daylight Egg Tester	570
Deadening the Hum of Line Wires	299

	Page
Deaf, Aids to the Partially	125
Deaf Children Visit Telephone Exchange	472
Deaf Mutes' "Telephone"	152
Death From an Improvised Electric Needle	439
Death of Henri Poincare	619
Death of Prof. Antonio Pacinotti	146
Deceptacle and Plug, Water-tight	860
Deciphering Manuscripts with Ultra-Violet Rays	243
Decoration at a Southern Dinner, Table	71
Deep Sea Fish Carries a Searchlight	785
Delegates at American Conventions, Foreign	684
Demand in India for Electricity	860
Delivery Wagon, Three-Wheeled Electric	265
Demagnetizer, Green Automatic	197
Demagnetizing a Watch, Apparatus for	293
Demagnetizers, Watch	197
Demonstrating a Cigar	255
Demonstrating Gasoline Auto Trucks	736
Demonstrating by the Visiting Lady, A	70
Demonstration for French Farmers, Electrical	506
Dental Engine Operated by Dry Cells	567
Derelicts	516
Desert Earth Conducts Wireless Waves	874
Desert, Testing Wireless in the	186
Designs, Batiken Color	1344
Designs for Lamp Bases, Pottery	251
Desk Set, An English Telephone	61
Detector, A New	1355
Detector for Portable Set	844
Detector, Frenchman Invents New	717
Destruction of Animals, Humane	1286
Detector, The Magnetic	184
Determining Longitude by Wireless	620
De-tinning Process, French	508
Destroyer, Electricity Creator and	657
Destroying the Browntail and Gypsy Moths	669
Destroying the Vampires of the Deep	516
Detroit's Beautiful Water Festival, Cadillaqua	544
Device to Suppress Undesirable Telephone Noises	994
Diamond Electric Sign, The	1180
Diamond to Coke, From	397
Diamond with Flashlight, Hunts	328
Dictating Letters by Telephone	668
Dictograph, The	129, 355
Digging Pole Holes with Dynamite	502
Dignity of the Electric Sign	759
Dignity of the Wireless, The	204
Dime in the Slot and a Photo in One Minute	42
Dining Room Railway, Paris Engineer's Odd	76
Dining Table Cutlets	1241
Dinner, Table Decoration at a Southern	71
Direct and Indirect Fixture, Combined	1243
Direct Current Motor, The Largest	441
Directory, The Electrical	409
Directory of Wireless Clubs, 289, 385, 483, 595, 724,	970
Discoveries Regarding Magnetic Metals, New	397
Disappearing Laboratory Table, A	357
Disease, Electricity and the "New Attitude" Toward	579
Dishwasher, Electric Power	1082
Disinfector and Perfumer, Electric	1004
Dispatcher and Motorman, Signaling Between	914
Dispatching on the Canadian Pacific, Telephone	1322
Dispatching System for Taxicabs, Telephone	139
Display Accompanying Mt. Taal Eruption, Electrical	352
Display, Aerial Bridge	984
Display at FireChiefs' Meet, Flasher	960
Display, Baker's Window	986
Display Device, Shoe and Hosiery	165
Display, Flying Fountain Pen	297
Display Goods, Ferris Wheel to	296
Display, Hat Cleaners'	986
Display, Locksmith's	610
Display of Light Fixtures on a Bed	297
Display Rack, A Double Motion	296
Display, Revolving Turntable	297
Display, Auto-Rotor	294
Display Dictaphone	609
Display, Fashion	610
Display, Manchester Traction, Light and Power Company	1244
Display, Restaurant	1245
Display, "Save a Dollar"	985
Display Shades and Lamps, To	97
Display Space, Utilizing an Out-of-the-Way Corner for Effective	740
Displaying Anglers' Supplies	296
Displaying Automobile Tires	497
Displaying Auto Trucks	736
Displaying Butterflies	498
Displaying Fans	392, 609
Displaying Flags	496
Displaying Garden Hose	496
Displaying Lawn Mowers	497
Displaying Moving Bicycles	498
Displaying Safety Razors	497
Displaying Shoes	735
Displaying Shoe Brushes	734
Displaying Typewriters	735
Displaying Wagons	498
Displaying Wigs	493
Displays, Emphasizing Window	497
Diver's Outfit Equipped With Telephone	1201
Divining Rod, The	1043
Division Bell by "Wireless"	490
Dock, Electrically Operated Floating Dry	339
Docked Vessels, Telephone Service to	898
Doctor's Portable Power Plant	1379
Dodd, Philip Stephens	824
Doherty, Henry	122
Doing Business Between Bites	609
Doll, The Dancing	183
Domestic Revolution, The	1344
Door Alarm	710
Door Alarm, Open	729
Door and Window Alarm Contacts	983
Door Bell Alarm, A Simple	95
Door Lighting Switch, Automobile	1269
Doorbell, A Magneto	361
Double Appeal for Customers	1245
Double Deck Electrotrains in London	111
Double-Deck Stepless Car, New York's	527
Double Jet Gasoline Torch	860
Double Motion Display Rack, A	296
Douche, The Hot Air	920
Down à la Etoile in the City of Toys	838
Do You Believe in Signs?	557
Dr. Bell Reminisces After 35 Years	340
Dr. Bergonie's Apparatus	1325
Dr. Eyde's Work in Electrical Production of Nitrogen	741
Drafting Instruments and How to Use Them (Book Review)	748
Drainage of a Coal Field, Electric Power	1331
Drawing Table, Light Adjuster for the	89
Dream of Elias Howe, The	952
Dressing the Hair	953
Dressmaker's Illuminated Sign	785
Drier for the Job Printer, Paper	167
Drill, A Giant	569
Drill and Fish Wire, Combined	1362
Drilling in the Oil Fields, Electric	1209
Drill, Reciprocating Electric	55
Drill with Adjustable Table, Paper	695
Drinking Water by the Violet Ray, Sterilization of	578
Drip Pan Alarm, Ice Box	732
"Drop in a Good One, Please"	587
Drop Light Conductor	733
Drops of Water, The Electricity of	1171
Dry Cells, Boxing and Connecting	1372
Dry Cells, Dental Engine Operated by	567
Dry Dock, Electrically Operated Floating	339
Dry Dock for British Battleships, Floating	767
Dryer for Letter Press Copies, Electric	163
Drying of Peat, Electric Osmose in the	861
Drying Telephone Cables	1241
Duelling School, An Parisian	211
Dundee, Railless Electric Traction In	1067
"Duraluminum"	1124
Dust Collector on Polishing Machines	59
Dusting, Modern	1345
Dust Pictures	586
Dust Proof Motor, Making a	873
Dust, Settle Cement	
Duster for Vacuum Cleaners	795
Dyeing Cloth, Electricity Used in	1326
Dynamite, Digging Pole Holes with	502
Dynamo, Construction of a 50 Watt	854, 972
Dynamos, Filtering Air for	167
Dynamo, The Largest Direct Current	441

E

Page

Early Electric Motors..... 1387
Earnings of Electric Companies..... 1378
Earphones, Theater 533
Earth, Conducts Wireless Waves, Desert 874
Earth Electrical Clock, The Only..... 1088
Ear, Which is Your Telephone..... 997
"Easy" Washing Machine..... 819
"Eating Electricity"..... 1160
Eavesdropping by Science..... 129
Eclipse of Sun Affects Wireless Transmission 381
Eclipse of the Sun Affects Wireless Signals 852
Eclipse With Selenium Cell, Recording.. 449
Economical Lighting in a Pumping Plant 1187
Economy of Electric Ware..... 1152
Edgar, Charles L..... 121
Edison Among the Great Manufacturers 749
Edison as a Manufacturer..... 625
Edison Honored, T. A..... 876
Edison Rectifier, The New..... 358
Edison, Thomas A..... 105
Edison's Newest Invention, "Talking Movies"..... 1204
Edison's Principles Still Followed..... 915
Edison's Twentieth Century House..... 948
Effective Indoor Sign..... 1065
Effective Night Billboard Lighting..... 694
Effect of Ionization on Wave Propagation 846
Effect of Magnetism on Watches..... 1279
Effects of Artificial Light on Hangings.. 953
Effects of the Metallic Filament..... 787
Efficient Plan for Canvassing Election Returns 646
Efficient Wireless Set, An..... 845
Egg Incubator, A 60,000..... 560
Egg Tester, Daylight..... 570
Egg Tester, Portable..... 983
Eggs with X-Rays, Inspecting..... 394
Elgin, W. C. L..... 121
Eiffel Tower, Plans to Outdo..... 1042
Election Returns, Efficient Plan for Canvassing 646
Election Returns, Flashing..... 1114
"Electra" Runabout..... 268
Electrascore, The..... 584
Electric Chair in the Charleston State Prison 336
Electric Dryer for Letter Press Copies.. 163
Electric Fans in India..... 163
Electric Furnace, A New..... 299
"Electric Lighting" (book review)..... 996
Electric, Mayor of Wheeling in His decorated 419
Electric Meterman's Handbook (Book Review) 505
Electrical Age, Training Youth for..... 834
Electrical Colloids..... 356
Electrical Invention and a Larger Patent Office 648
Electrical Securities.....30, 133, 237, 330, 499, 615, 742, 1246, 1375
Electrician in Fireproof Buildings, For the 493
Electrician, Making of the Naval..... 410
Electrician's Stationery, The..... 1109
Electricity, A Cent's Worth of..... 371
Electricity Aids the Date Industry..... 150
Electricity and Memory..... 397
Electricity and the "New Attitude" Toward Disease 579
Electricity, Brandy and Champagne..... 1114
Electricity Cheaper Than Steam in Seattle Mills..... 140
Electricity Creator and Destroyer..... 657
Electricity Direct from Heat..... 151
Electricity from Heat..... 125
Electricity from the Air, Collecting Static 245
Electricity, Indian Boys Advertise..... 587
Electricity in Embroidery Designing... 263
Electricity in Flames..... 376
Electricity in Locomotion (Book Review) 300
Electricity in Place of Food..... 529
Electricity in the Summer Home..... 170
Electricity Introduces Juggling Act.... 182
"Electricity, Its History and Development" (Book Review)..... 1
Electricity on Fujiyama..... 769
Electricity Versus Gravity System for Irrigating 157

Page

Electrification, London Railway..... 1252
Electrification Project for Berlin, Immense 258
Electrification, The St. Gotthard..... 874
Electrifying a City..... 354
Electrifying Steam Roads..... 1009
Electrifying the Checker Game..... 73
Electrifying the Railroads of a Whole Country 803
Electro-Chemical Wonders 754
Electro-Chemistry and Precious Gems.. 1275
Electro-Chemistry and Promises it Holds Forth 987
Electro-Culture, International Congress of 747
Electrodes, Mineralized Carbon Lamp... 1153
Electro-magnet 770
Electro-Magnet a Veritable Aladdin's Lamp 456
Electro-Magnet for Treating the Eye... 784
Electro-Magnet, Safe Expert Uses an... 11
Electro-Magnet With Automatic Switch 198
Electro-Magnetic Rotation Experiment. 473
Electro-Magnetic Velocity..... 1125
Electro-Plating Aluminum..... 1278
Electro-Plating Process, An English.... 784
Electro-Plating on Glass and Porcelain. 199
Electro-Sanitation Plant in Brazil, An.. 1177
Electrobus in London, Double Deck..... 111
Electrocution 781
Electrocution of Superfluous Animals... 1069
Electrolier and Vase, Cut Glass..... 933
Electrolier, What Is an..... 1114
Electrolysis, A Remarkable Case of..... 44
Electrolysis of the Teredo..... 142
Electrolysis of Water..... 977
Electrolytic Copper Refining in Norway 937
Electrolytic Iron..... 1267
Electrolytic Interrupter..... 592
Electrophorus, To Make an.....181, 958
Elementary Electricity for Practical Workers 1364
Elephant's Heart Beats Recorded by Electricity 407
Elevated Railway for Trolley Cars, An.. 1309
Elevated Line, Surface Cars on an..... 453
Elevator, An Outdoor..... 136
Elevator, Displays Shoes, Miniature.... 735
Elevator, Stepping on Mat Signals..... 787
El Ilano 471
Elias Howe, The Dream of..... 952
Elks, Of Interest to..... 1061
Emancipated 471
Embroidery Designing, Electricity in.... 263
Emergency Extension Plug..... 1256
Emergency Lines of Communication, Uncle Sam's 8
Emergency Pumping Outfit..... 558
Emergency Strain Insulator..... 981
Emergency Torch for Electricians..... 293
Emphasizing Window Displays..... 497
Empire of the Future, An Electrical.... 305
Energy from the Lines of force..... 585
Engaging Servants by Wireless..... 1123
Engine by Cable, Transporting an..... 1087
Engine Operated by Dry Cells, Dental.. 567
Engineer Alive, Proving the..... 149
Engineering as a Vocation (Book Review) 300
Engineering Education 552
Engineers' Club, Electric Broiling in the 1061
Engineers, College Training of Electrical 446
Engineer's Fuse Kit, Wireman's and.... 390
Engineer's Odd Dining Room Railway, Paris 76
Engineer, Specifications for a Good..... 328
Engineer, The Making of an..... 682
Engineer, The Practical..... 810
England, Sheep Shearing in..... 1060
English and American Practice Compared, Electric Wiring.....486, 597
English Blue-Print Machine..... 1008
English Boy Scouts Studying Wireless.. 382
English Chanel, Laying Telephone Cable in 112
English Channel, Tunnel Under the..... 993
English Electrical Affairs, Sir Joseph Beecham 660
English Electric-Plating Process..... 784
English Royalty at the Aldershot Experiments 335
English Telephone Desk Set, An..... 61
English Telephone Operators Compared Promptness of American and..... 264

	Page
English to the Technical Man, The Value of	910
Entered Apprentice and the Electric Laundry Machine, An	1083
Entertaining Revolutionized, Public	1202
Entrance Wires, Neat Fastening for	199
Enunciation, Commended for Telephone	959
Equipment in Japanese Mines, American	815
Ernest Freeman	1210
Euphonius Chemistry	41
European Farm Motor	165
Eustis Turbine Windmill, The	1033
Evaporation of Metals, The	917
Evil Lighted Into Harmless Gayety	441
Examining Coal with X-Rays	618
Execution by Electricity	336
Experiment in Magnetism, An Interesting	373
Experiment, The Frog Muscle	1097
Experimental 200 Meter Wave Sets.1228,	1352
"Experimental Wireless Stations" (Book Review)	1125
Experimenting With Large Induction Coils	282
Experiments in Magnetic Action	1273
Experiments with Electricity, Simple	1089
Experiments with Selenium	1303
Explanation of the Static Trick, Another	837
Exploring Cables with the Telafault	12
Explosion of Radium	620
Exposition Begun, Construction of the 1915	1194
Exposition, Electricity Building at Panama-California	1180
Extension Bell, Telephone	1199
Extension Bells for Annunciator	440
Extension Lamp Arm	59
Extension Plug, Emergency	1256
Extremes Meet in the Antipodes	405
Eyde's Work in Electrical Production of Nitrogen	741
Eye, Electro-Magnet for Treating the	1294
Eye Magnet, Knife Blade as	983

F

	Page
Face Steaming, Electric Heater for	679
Factory Signal, Automobile Horn for	494
Faryland Discovered	710
Faithful Friends, In Recognition of	1174
Fan Advertisement	609
Fan, A New Type of	164
Fan, Automatic Control of a	390
Fan Breeze, Flies a Solid	554
Fan Creation, A New Electric	566
Fan Display, A "White Hope"	392
Fan Facts	370
Fan Guard, New Type	570
Fan in Blacksmith Shop	1043
Fan, Storing the Electric	997
Fan with Fern Dish, Table	582
Fans for Sealing Room	294
Fans in India, Electric	163
Fans in the Stable, Electric	439
Fancy, An Electrical	1
Farraday Centenary, The	1269
Farm, An Ideal Electric Plant on a	1291
Farm, by the Power of a Brook, Running a	1058
Farm Electrified, A Pennsylvania	138
Farm, Ice Harvesting on the	664
Farm Engineer, A Future for the	**1062**
Farm Lighting, Electric	431
Farm Lighting Plant, Windmill	655
Farm Lights and Farm Motors	945
Farm Motor, European	165
Farmers, Electrical Demonstration for French	506
Farmers Tap the German Transmission Lines, How	1
Farmers Use Niagara Power, Canadian	1161
Farming by Electricity Demonstrated	494
Farming, Electrical	1056
Farms, Electricity at Crescent	913
Farrand Dudley	120
Fashion Cabinet	610
Fastening for Entrance Wires, Neat	199
Fault Finder	1249
Federal Household Power Table	176
Federal Wireless Station at Central Point, Ore.	588
Felling Trees with Electric Saw	1073
Felting Tool, The Electric	459
Ferguson, Louis A.	119
Fern Dish, Table Fan with	582
Ferris Wheel to Display Goods	296
Ferry Boats, Wireless on	506
Festival, Cadillauqq-Detroit's Beautiful Water	544
Fiber, Pliers Made from	201
Fielding, Jr., G. T.	165
Filament, Effects of the Metallic	787
Filament Plays Trick, Tungsten	1308
Filaments, Lamp	799
Film Mending Machine	1109
Films, Static Electricity Fogs	636
Filtering Air for Dynamos	167
Finish for Electric Fixtures	898
Fire and Burglar Alarm Switch	266
Fire, An Imitation Coal	91
Fire Chiefs' Meet, Flasher Display at	960
Fire Damp, Bell System Proof Against	1380
Fire Damp by Breaking Incandescent Lamps, Ignition of	1285
Fire Engines for Electric Propulsion, Remodeling	252
Fire Fighters, Paris	636
Fire Fighting and Irrigation, Portable Pump for	364
Firebug, Electric Searchlight	759
Firefly, Light of the	884
Firefly's "X-Ray" Light, The	205
Fireless Cooker, Quad Electric Stove and	699
Fireproof Buildings, For the Electrician In	493
Fireworks Displays, Electricity in the Control of	665
Firing Flashlights Electrically	96
Firing with Wireless, Blast	1122
First Metallic Metallic Telephone Circuit, The	1014
First Carborundum Furnace, The	796
First Electrically Driven Naval Vessel, Our	778
First Money Earned from the Telephone	245
First Quartz Lamp Installation in This Country	635
First Thanksgiving Week, The	702
Fish, Carries a Searchlight, Deep Sea	785
Fishing Boats Equipped with Wireless, Holland	393
Fishing Boats, Wireless on	190
Fishing, Five Hundred Fifty Volt	960
Fishing in the Old Mill Pond	98
Fishing Up a Cable	1227
Fishing Wire and Its Manipulation	290
Fish Wire and Rod Combined	1362
Five Hundred Fifty Volt Fishing	960
Fixture, Combined Direct and Indirect	1243
Fixture Control, Convenient	93
Fixture Holder, Suction Cup	1209
Fixture Straightener, A	293
Fixtures, Finish for Electric	989
Fixtures Is Made, How Brass for	1242
Flags, Wheel of	496
Flasher, A Simple	90
Flasher Display at Fire Chiefs' Meet	960
Flasher, The Largest Sign	804
Flashing Electric Signs	114
Flashlight Apparatus, Portable	695
Flashlight Device, Electrically Controlled	694
Flashlight Directs Night Rescue	18
Flashlight for Signaling	282
Flashlight, Hunt Diamond with	1328
Flashlight in Policeman's Club	521
Flashlights Electrically, Firing	96
Flasks from Electric Bulbs, Chemical	181
Flatiron, Electric	471
Flatirons, Wiring System for	294
Fleeing from Electricity	1307
Flexalite Candle, The	461
Flexible Lamp Arm	458
Flexilyte Lamp, The	579
Flickerless Moving Pictures	1320
Flies Avoid Fan Breeze	454
Floating Dry Dock for British Battleships	767
Floating Dry Dock, Electrically Operated	339
Floating Power Plant Protects Piling	142
Floor Light, Portable	924
Floor Scrubbing Machine	460
Floor Tread Switch, A	199
Flower Holder, Illuminated	1079
Flow of Large Streams, Measuring the	43
Fly Chaser for the Baker's Window	986
Flying Fountain Pen, The	297
Fly Killer, Electric	709
Flywheel Motor Starter	1382

	Page
Food, Electric	1123
Food, Electricity in Place of	529
Fooling the Chicken Thief	74
Foot Amputated by Wireless Instructions	301
Forge Blower, A	1003
Foreign Delegates at American Conventions	684
Foreign Language Over Telephone, First	247
Forest Service, U. S., Telephone Stations of	800
Formalities to Be Observed in Connection with the New Wireless Law	964
Formation of Imitation Crystals	378
Formosa, Surprising the Barbarians of	218
For the Man Who Shaves Himself	1008
Fortuny Stage Lighting	341
Foster, Horatio A	62
Fountain of the "Peace Palace" at Washington	906
Fountain Pen, The Flying	297
Fountains in the Place de la Concorde, Paris	264
Four Methods of Picture Projection	55
Fourth, New York's Electrical	432
France, Aeroplane Wireless Experiments in	1096
France, A Funeral Car in	909
France, Overhead Construction in	896
France, The Increased Cost of Living in	1233
Frank Morrison Tait	573
Freak Car Line, Chicago's	1332
Freak Ordinance	899
Freeman, Ernest	1210
Freeman, George F	151
Freeman, W. Winans	118
"Freezing Out" the Resistance	1
French Air Pilots, Weather Bulletins for	1095
French Automobile Searchlight	1064
French De-Tinning Process	508
French Farmers, Electrical Demonstration for	506
French Inventor of the Telephone—Charles Bourseul	1168
Frenchman Invents New Detector	717
French Water Sterilizer	656
Freshmen, Advice to	326
Frightening Badgers with a Searchlight	159
Frog Muscle Experiment, The	1097
Frog Muscles, Wireless Signals Registered by	961
From Ingot to Wire	1188
Frost Prevention, Electric	1143
Frost, Tree Vibration for Saving Buds From	528
Frozen Water Pipes, Thawing	1187
Fuel of the Bad Lands, Cheap	509
Fujiyama, Electricity on	769
Fundamental Principle of Electric Cooking	72
Funeral Car in France, A	909
Furnace, A New Electric	299
Furnace Gas Analyzer	689
Furnace, Prof. Moissan's	637
Furnace, Steel Refining	779
Furnace Temperatures, High	491
Furnace, The First Cyrundum	766
Furnace, Tungsten Electric	1069
Furs, A Cold Storage Plant for	674
Fuse Kit, Wireman's and Engineer's	390
Future, An Electrical Empire of the	305
Future for Electric Power in Ireland, Bright	1288
Future for the Farm Engineer, A	1062

G

	Page
Galvanic Packing, A	294
Galvanizing Press, New	1381
Galveston Bay, Great Causeway Across	526
Garage for Electrics, Huge	1014
Garages, Current Converter for Private	56
Garden Electrically Decorated, A Palace	325
Garden Hose Display	496
Gas Analyzer, Furnace	689
Gas and Electric Lights, Color Composition of	1031
Gas from Cable Vaults, Pumping	463
Gas Headlights, Lighter for Auto	729
Gas Lighter, How to Make an Electric	92
Gas Mantles, Radium Rays from	507
Gas Fixtures to Electric, Converting	1370
Gaskill, D. L	452
Gasoline Auto Trucks, Demonstrating	736
Gasoline-Electric Motor Cars	1380
Gasoline-Electric Car	934
Gasoline-Electric Automobile, Self-Starting	540
Gasoline-Electric Omnibuses in London	747
Gasoline-Electric Street Sweeper	58
"Gasoline Engine Trouble Chart"—Book Review	1254
Gasoline Torch, Double Jet	860
Gate, Lamps on Crossing	431
Gems, Radium Rays in Coloring	541
General Alarm for Telephone Systems, A	1024
General Utility of the Modern Searchlight	1006
General Electric Co	1018
Generator for Country Homes, Automatic Electric	1257
Generator, Midnight Ride of 48-Ton	954
Generator, Odd Static	1225
Generators of the Keokuk Plant, Immense	451
Genius Released from Prison, An Electrical	241
George H. Harries	1074
German Airships, Wireless on	591
German Electric Candle, A	812
German Homes, Electricity in	702
German Miners' Electric Lamp	1320
German Precaution, A	53
German Sidewalk Signs	257
German Theater, Traveling Spotlight in	912
German Tranmission Lines, How Farmers Tap the	1
German Wireless Motor Car, A	716
Germany's Long Distance Wireless Operations	262
Germany, Street Car Efficiency in	653
Germany, Wireless Unit Time in	962
Getting Ready for the Opportunity	739
Getting Rid of the Tie Wire	388
Ghent, Palace of Light at	1252
Ghosts, Electric	1045
Giant Drill, A	569
Giant Electric Crane	1318
Giant Electric Incubator	1278
Giant Talking Machine	772
Giant That Knows No Mercy, A	621
Gilchrist, John F	115
Giraffo Telephonia	956
Girard College, Tower Lights of	247
Glaciers Transformed Into Electrical Energy	685
Glass Threads, Making	860
Glimpse Into Japanese Home Life, A	467
Glove for Auto Drivers Heated	932
Glove, New Kind of Insulating	1001
Glove, Signal Lamp on	244
Glowing Fruit, a Basket of	497
Goblet, The Luminous	280
Golden Arc Light, The	928
Gold, The Purging of Raw	774
Goldsborough, M. E., Winder Elwell	242
Gondola, Electric	799
"Good Ending" in Conduit, A	89
Good Light as an Asset	339
Government Telegraph Lines	8
Grain Draws Electricity from the Air, Bearded	1253
Grade, Safety Switches on Old Seventeen Mile	1319
Grand Central Terminal, New York's	1137
Glass and Porcelain, Electro-Plating on	199
Grass Cutting Advertisement	497
Gravel Handling, Power Crane in	897
Gravity Cells from Creeping, Preventing	391
Gravity System for Irrigating, Electricity Versus	157
Great Brazilian Wireless System	718
Great Causeway Across Galveston Bay	526
Great Lakes Naval Training Station, The	522
Great Manufacturers, Edison Among the	749
Great Northern Power Co	881
Green Automatic Demagnetizer	197
Greenback Laundry, A	663
Greenwich, The Time Signals of	993
Grinder, Portable	167
Grinding Down the Rails	45
Grinding Motor, Portable Polishing and	458
Grinding of Stove Plates, The	822
Grooming the Horse	1277
Grotto, The Gruenwald	46
Ground and Short Circuit Tester	976

Page

Growing Plants and Electricity..... 1388
Growth of Earnings of Electrical Companies 1378
Gruenwald Grotto, The..... 46
Grave Annunciator..... 40
Gauge, Illuminating the Steam..... 295
Guard, New Type Fan..... 570
Gun, Aiming and Firing Heavy..... 1223
Gun Carriages at the Krupp Works, Testing 657
Gun Sight, An Illuminated..... 980
Gypsy Moths, Destroying the Brown-tail 669
Gyroscope Exhibit..... 506

H

Hack Saw, Motor Driven..... 1385
Hail, Prevention of..... 319
Hailstorms, "Paragrele," to Prevent.... 768
Hair, Dressing the..... 953
Hair, Electric Comb for Drying..... 582
Hair Waver, The Permanent..... 1216
Hamburg, The Great Crane of..... 873
Hamburg's New Railway..... 329
Hanging the Bread on the Toaster..... 1136
Hanger for Arc Lamp, Cut-Out..... 690
Hangings, Effects of Artificial Light on 953
Handy Lamp Bracket..... 61
Handling Cane in Sugar Mills..... 167
Handling a Carnival Crowd in Manila.. 1227
Hard Rubber to Its Natural Color, Restoring Old..... 82
Hardened by Electricity, Tools..... 1309
Harmonizing Cord With Window Display 100
Harnessing the Nile..... 1318
Harper Memorial Library, University of Chicago 757
Harries, General George H..... 1074
Harvard Stadium Station, The..... 916
Hat Cleaner's Advertisement..... 986
Hat, How the Electric Won a..... 242
Headlight as Window Attraction, Moving 735
Headlights for Victims of Night Shipwrecks 258
Heart Beats, Baby Jumbo's..... 407
Heat Cells..... 1110
Heat, Electricity Direct from..... 151
Heat from Electric Lamps..... 1275
Heated Baptismal Fount, Electrically.. 932
Heated Coat for Astronomers..... 1290
Heated Glove for Auto Drivers..... 932
Heater, A Reflecting..... 523
Heater, An Electric Water..... 294
Heater for Face Steaming, Electric.... 679
Heater for the Table, Electric..... 659
Heater, New Type Instantaneous Water 166
Heaters, Continental Types of..... 521
Heaters and Irons, Tell-Tale Lamp for.. 460
Heaters for Church Pews, Electric..... 745
Heaters in a Water Tank, Electric..... 363
Heaters, The Location of Electric..... 668
Heating Combs Electrically..... 58
Heating Element, Incandescent Lamp as a 693
Heating in Sweden, Electric..... 645
Heating in Swedish Homes, Electric.... 205
Heats Water as Used..... 1134
Hedge Trimmer, Power Driven..... 1386
Henri Poincare..... 19
Heroes, Electrician..... 1290
High Furnace Temperatures..... 491
High Frequency Apparatus, Dr. Bergonie's 1325
High Frequency Electricity, Treating Young Fowls with..... 246
High Frequency Treatment, Bergonie's 1160
High Power Navy Equipment..... 190
High Tension Roof Wiring..... 1206
Highest Telephone Station in the World 994
Hints for Using a Toast Stove..... 482
Hints on Using the Long Distance Telephone 1048
Hippodrome and Its Electrical Stage Effects, The..... 900
Hiram Maxim's Collision Preventer, Sir 619
Historic Church, Electric Cross for..... 1208
Hoist, A Handy Contractor's..... 267
Holster, Motor..... 485
Holland Fishing Boats Equipped with Wireless 393
Home, Business Methods Good for the.. 71
Home, Electricity in the Summer..... 170
Home Life, A Glimpse Into Japanese... 467

Page

Home, Loud Speaking Telephone for the 643
Home Refrigerating and Ice-making Plant 172
Homes, Electric Heating in Swedish... 205
Homes, Electricity in German..... 702
Homes of Swiss Villagers, Electricity for the..... 1346
Home-made Cash Drawer Alarm..... 295
Home-made Electric Lamp, A..... 371
Home-made Electric Sign, A..... 198
Honolulu, Washington Greets..... 1232
Hook-up for Long Distance Work..... 190
Hope-Jones' Unit Orchestra..... 49, 1050
Horatio A. Foster..... 62
Horizontal Telephone Switchboard.... 1271
Horn for Factory Signal, Automobile... 494
Hornum Lighthouse..... 1152
Horse Car in Snowstorm, New York.... 1351
Horse Feed, Electric Vehicles and..... 12
Horse, Grooming the..... 1277
Horse, Starter for a Balky..... 1086
Horse, Warm Meals for the..... 1186
Horses Cool and Comfortable, Keeps.... 439
Horsepower Really Measures in Watts, What 621
Horticulture, Electrical..... 1175
Hose Display, Garden..... 496
Hosiery Display Device, Shoe and..... 165
Hospital, Animal..... 1174
Hospital Signal Systems..... 406
Hot Water Douche, The..... 920
Hot Wire Meter, A..... 80
Hotel Clerk's Private Exchange Board.. 1242
Hotel, Electric Cooking in a Modern.... 704
Hotel for Radium Bathers..... 408
Hotel, Manila's New..... 941
Hotel, What Is Electrically Charged.... 42
Hotel With 200 Electric Clocks..... 394
Hour, The Universal..... 1233
House, Edison's Twentieth Century.... 948
House Numbers, Illuminated..... 864
House With Vacuum Cleaner, Modern.. 270
House Wiring a Simple Problem..... 69
House Wiring, Conveniences in..... 733
House Wiring (Book Review)..... 300
Household Ozonator..... 367
Household Portable Power Table, The.. 176
Household Sciences, Chemistry and..... 468
Household Show, Observations at a.... 272
Household Waste, Electricity from..... 298
Householders, Know Your Meter..... 86
Housekeeping, Tools for..... 176
Housewife, The Art of the..... 1081
Housewives, Thoughts for..... 1221
How Brass for Fixtures Is Made..... 1242
How Electric Ware Is Constructed..... 996
How Much Will It Lift?..... 770
How the Swiss Exploit Their Scenery.. 1165
How the Electric Won a Hat..... 542
How to Comply With the New Wireless Law..... 719
Huge Garage for Electrics..... 1014
"Human Spiders," London's..... 645
Humane Destruction of Animals..... 1286
Humidifier for Mines, Air..... 1134
Humidor, Tobacco Jar 1242
Hum of Line Wires, Deadening the..... 299
Hunts Diamond With Flashlight..... 328
Hydro-Electro Dam Surmounted by a Roadway 824
Hydro-Electric Wonders in California.. 2, 227, 320, 434
Hydrogen, The Production of..... 397
Hygrometer, An Electrical..... 146

I

Ice Box, An Illuminated..... 465
Ice Box Drip Pan Alarm..... 732
Ice Harvesting on the Farm..... 664
Ice Insulated Conduits 869
Iceland, Water Power of..... 458
Ice Making Electric..... 770
Ice-making Plant, Home Refrigerating and 172
Ice, Saving a Power House From the.. 355
Ice, Storage Battery in a Cake of..... 926
Ideal Bed Blanket, An..... 1082
Ideal Central Station Plant, An..... 638
Ideal Electric Plant on a Farm, An..... 1291
Ideal Insulator, The..... 408
Ideal Realized, An..... 832
Ignition, Motor Boat..... 1101

	Page
Ignition of Fire Damp by Breaking Incandescent Lamps	1285
Illinois University Electrical Show	930
Illuminated Checkerboard Table	75
Illuminated Flower Holder	1079
Illuminated Gun Sight, An	980
Illuminated House Numbers	864
Illuminated Ice Box Sign, An	465
Illuminated Key Sign, An	610
Illuminated Music	535
Illuminated Semaphore Signal	1045
Illuminated Sign, Dressmaker's	785
Illuminated Speed Indicator	1153
Illuminated Vest Buttons	572
Illuminated Water Plane, Electrically	687
Illuminating a Carnival	49
Illuminating the Steam Gauge	295
Illuminating the Thermometer	697
Illumination of the Christmas Festival, The	830
Illumination of Niagara Falls	673
Illumination of Racket Courts, Special	803
Illumination of Works of Art	276
Illuminations of One of the Large Fountains in the Place de la Concorde, Paris	264
Images of Opaque Objects, Projecting	933
Imitation Coal Fire, An	91
Imitation Crystals, Formation of	378
Immense Generators of the Keokuk Plant	451
Immense Projecting Sign, An	23
Improved Carbon Holder for Moving Picture Machine	982
Improvement in Leyden Jars	1100
Improvement in Moving Picture Machines	200
Incandescent Lamp as a Heating Element	693
Incandescent Lamp as a Telephone	1307
Incandescent Lamps, Ignition of Fire Damp by Breaking	1285
Incandescent Lamp, Moving Pictures by	1259
Incandescent Lamps, Powerful	866
Incandescent Lights, Arc and	114
Income Yield, List of Bonds Showing	1377
Income Yield of Selected Bonds	1249
Increased Cost of Living in France, The	1233
Increasing a Telephone's Range of Usefulness	199
Increasing the Sound of a Telephone	995
Incubator and Brooder, Electric	1181
Incubator, A 60,000 Egg	560
Incubator, Giant Electric	1278
India, Electric Cooking in a Palace of	1342
India, Electric Fans in	163
India for Electricity, Demand in	360
Indian Boys Advertise Electricity	587
India, Possibilities of Trade With	1127
Indicating Push Button	732
Indicator, Electric	1002
Indicator for Electric Cars, Street	926
Indicator, Illuminated Speed	1153
Indicator, Nursery Noise	909
Indirect Fixture, Combined Direct and	1243
Indirect Illumination in the Art Institute, Chicago	275
Individual Lights From the Switch Cabinet, Tapping	732
Individual Telephone Transmitter	149
Indoor Sign, Effective	1065
Induction Coils, Experimenting With Large	282
Inductive Tuner, Interference and the	78
Industrial University, An	859
Industry Electrified, An Ancient	209
Infroit's Radiographic Laboratory	1151
Ingenious Advertisement	825
Ingenious Safety Device, An	980
Ingot to Wire, From	1188
Insects Out of Lamp Globes, Keeping	528
Insidious Loss That Invites Attack, An	421
Inspecting Eggs With X-Rays	394
Installment Plan, Buying Stocks and Bonds on	1250
Instantaneous Water Heater, New Type	166
Instructor's Variable Resistance Unit	1320
Instrument Sterilizer	1133
Insulating Glove, New Kind of	1001
Insulating Nail	1361
Insulation From Seaweed	345
Insulator, A New	567
Insulator, Emergency Strain	981
Insulator, Odd Current Distributing	1109
Insulators, Strain	728
Insulator, The Ideal	408
Insulator, Tree	570
Insulator, Universal	199
International Congress of Electro-Culture	747
Interesting Experiment in Magnetism, An	373
Interesting Trick With Static, An	583
Interference and the Inductive Tuner	78
International Candle, The	1260
International Wireless Congress	507
Interrupter, Electrolytic	592
Interurban Stations, Modern	1295
In the Copper Country	790
Inventing, Should It Be Taught?	867
Invention and a Larger Patent Office, Electrical	648
Invention of the Acousticon, The	355
Inventions and Patents	395, 503
Invention of the Telephone—Charles Boursel, French	1168
Inventor, Who He Is and Why, The	611
Investment, Bonds as an	1121
Invigorator, Electricity as an	1221
Invisible Multiple Rotary for Windows	736
Ionization, Effect of, on Wave Propagation	846
Ireland, Bright Future for Electric Power in	1288
Iron Economy, Pressing	1004
Iron, Electrolytic	1267
Iron, Lightning Bores	520
Irons, Cost of Operating Electric	1345
Irons, Telltale Lamp for Heaters and	460
Irons, Wiring System for Electric	294
Irrigating, Electricity Versus Gravity System for	157
Irrigation, Portable Pump for Fire Fighting and	364
Isaac Waltons, Attracting the	296
Islanders, Wireless News for Desolate	81
Is It Possible at This Age?	779
Italian Cars, Odd Current Collectors on	1324

J

	Page
Japanese First Foreign Language Transmitted Over the Telephone	247
Japanese Home Life, A Glimpse Into	467
Japan, Laying Lighting Cables in	534
Japanese Mines, American Equipment in	915
Jerusalem, Telephones in	685
Jeweler, Profuse Light Pays the	805
Jeweler's Power Motor	267
Jewels, Electricity Enhances	471
Job Printer, Paper Drier for the	167
Joints, Tool for Forming Wire	728
Joint, New Rail	1337
Jolly Gymnast, The	610
Joseph Beecham Comments on English Electrical Affairs, Sir	660
Judgment for the Marconi Company	1357
Juggling Act, Electricity Introduces	182
Jumbo—A Relic of the World's First Central Station	1030
Jumbo's Heart Beats, Baby	407

K

	Page
Karapetoff, Vladimir	1334
Keeping Insects Out of Lamp Globes	528
Keeps the Loom in Place	391
Keeping Tab on an Electric Wagon	1254
Keeping the Motorman Warm	733
Kelvin, Presentation of Bust of Lord	340
Keokuk Plant, Immense Generators of the	451
Kerosene Torch	1005
Kettle in Window, Candy	97
Kinetophone	1204
Kitchen, A Municipal	1379
Kitchen Cabinet, Service	271
Kitchen to Become a Laboratory, The	72
Kites, Lightning Discharges From	1323
Knapsack Wireless Outfit	718
Knife Blade as Eye Magnet	983
Knob and Tube and Cleat Wiring	1359
Knots, Splices and Rope Work (Book Review)	300
Korea, San Francisco Hears Wireless From	189
Korn Picture Sending System	240
Krupp Works, Testing Gun Carriages at the	657

L

Page

Labeling Seattle's Railway Station..... 769
Laboratory Air Pump From Bicycle Pump 1350
Laboratory, Dr. Infroit's Radiographic.. 1151
Laboratory for Air Surveys, Movable.... 925
Laboratory Table, A Disappearing..... 357
Laboratory, the Kitchen to Become a.. 72
Laboratories of the Sorbonne, Wonderful 1070
Lacquer for Lamp Globes, Colored..... 1373
Ladder for Lamp Tending..... 1114
Lady, Demonstration by the Visiting.... 70
Labej, Light for the Sultan of..... 647
Lake Boat, Electric Propulsion for..... 656
Lake Tchad Region, Curious Electrical Effects in..... 874
Lamp, A Home-made Electric..... 371
Lamp, A New Electric Vapor..... 1260
Lamp, A Piano..... 494
Lamp, A "Polychrome"..... 266
Lamp Arm, Extension..... 59
Lamp Adjuster 458
Lamp Adjuster, Magna..... 694
Lamp Arm, Flexible..... 458
Lamp as a Heating Element, Incandescent 693
Lamp as a Telephone, Incandescent..... 1307
Lamp Bases, Pottery Designs for..... 251
Lamp Bracket, Handy..... 61
Lamp Carbon Stubs, Saving Lamp..... 664
Lamp, Combination Electric and Oil..... 996
Lamp Cord Adjuster, An Approved..... 266
Lamp, Cut-Out Hanger for Arc..... 691
Lamp Exhibit, Unique..... 1251
Lamp Filaments 799
Lamp, Flexilyte 579
Lamp for Heaters and Irons, Tantale.. 460
Lamp for Photography, Combination... 601
Lamp, German Miners' Electric..... 1320
Lamp Globe, Advertisement on..... 985
Lamp Globes, Colored Lacquer for..... 1373
Lamp Globes, Keeping Insects Out of.. 528
Lamp in Medicine, The Quartz Mercury 313
Lamp in Socket, Locks 90
Lamp Installation in This Country, First Quartz 635
Lamp, Largest Incandescent..... 1044
Lamp Letter Sign, Miniature..... 440
Lamp Light, A Window of Blooms by.. 66
Lamp, Long Cord Turn Down..... 268
Lamp, Natural Light for Mercury Vapor 768
Lamp, Nernst 299
Lamp, Novel Tube..... 426
Lamp on Gloves, Signal..... 244
Lamp Post, Barber Pole as a..... 1245
Lamp, Ruby 391
Lamp Socket Attachment..... 567
Lamp Stand, Adjustable..... 694
Lamp Tending, Ladder for..... 1114
Lamp Trimming and Maintenance, Electric Car for..... 934
Lamp, White Light from Coal Mercury. 1122
Lamp, Veluria Glass Table..... 1081
Lamps as Time Limit Signal to Speakers 393
Lamps, For Transporting..... 1302
Lamps, Heat From Electric..... 1275
Lamps, Miners' Safety..... 1034
Lamps, New Way of Making Quartz Tube 746
Lamps on Crossing Gate..... 431
Lamps "on," Testing for..... 601
Lamps, Ornamental Luminous Arc..... 543
Lamps, Powerful Incandescent..... 866
Lamps Superior, American..... 340
Lamps, Time Savers in Testing..... 95
Lamps, To Display Shades and..... 97
Lamps to Prevent Theft, Locking Up... 58
Landmark That Turned a Trolley Line, A 562
Lantern, Electric 1258
Lantern, Portable Safety Electric..... 264
Larger Patent Office, Electrical Invention and 648
Largest Lightning Arrester in the World 158
Largest Sign Flasher, The 804
Largest Water Turbine, The..... 1337
Laundered Currency, Counting..... 1272
Laundering Machines, The Perfected... 250
Laundry, A Greenback..... 663
Laundry in Bank Vault 57
Laundry Machine, Entered Apprentice and 1083
Law, Formalities to Be Observed in Connection With the New Wireless.. 964

Page

Law, How to Comply With the New Wireless 847
Law of Ohm, Men Who Follow the..... 115
Layman, Waldo Arnold..... 462
Laying Cables in Barbados..... 1077
Laying Lighting Cables in Japan..... 534
Laying Telephone Cable in the English Channel 112
Lead, Coating Metals With..... 301
Lead Pencil, The Wizard..... 959
Lead Pipe Storage Battery..... 585
Lead Sheaths on Cables, Putting the... 1068
Leakage Alarm for Boats..... 91
Leaning Tower of Pisa..... 137
Leaning Tower, Street Cars to the..... 137
Learning the Telegraph Code..... 280
Leave the Electric Wiring Alone..... 875
Le Nouene "Microtelephone"
Lesson in Values, A..... 1214
"Lessons in Wireless Telegraphy" (Book Review) 1254
Letter Press Copies, Electric Dryer for. 163
Letter Sign, Miniature Lamp..... 440
Letters by Telephone, Dictating..... 668
Leyden Jars, Improvement in..... 1100
Library, Gift to the Boston "Tech"..... 509
Library, Harper Memorial, University of Chicago 757
Lifting Magnet, Capacity of a..... 729
Life Raft, Novel..... 1143
Life Saving, Electric Headlights in..... 258
Life Savers, Electric Signal for..... 226
Light, A Cheap Mellow..... 201
Light Adjuster for Writing Table.. 89
Light, A Window of Blooms by Lamp.. 66
Light, Cold 1059
Light Counter-Balance, Drop..... 733
Light Fixture, Odd Window..... 99
Light Fixtures, Mission Street 468
Light Fixtures to Be Tested..... 297
Light for Birds, Electric..... 841
Light for Memorandum Pad..... 572
Light for Mercury Lamp, Natural..... 768
Light for Sultan of Lahej..... 647
Light for the Blacksmith..... 96
Light from the Cooking Range..... 1015
Light from the Mercury Lamp, White.. 1122
Light Holder and Stand, Collapsible Electric 1133
Light in a German Theater, Traveling Spot 912
Light, Unexpected Places, Electric.. 1269
Light: Its Use and Misuse..... 1025
Light, Missoula's Lane of..... 1213
Light of the Firefly..... 884
Light, Portable Floor..... 924
Light, Portable Street..... 391
Light, Revealing Power of..... 1176
Light, Steps Turn Off Cellar..... 1363
Light, The Firefly's X-Ray..... 205
Light, The Golden Arc..... 928
Lights, Arc and Incandescent..... 114
Lights Along the Nile Rising..... 1173
Lights as an Asset, Good..... 339
Lights, Automatic Tunnel..... 1279
Lights, Color Composition of Gas and Electric 1031
Lights for Victims of Night Shipwrecks, Hints 258
Lights from the Switch Cabinet, Tapping Individual..... 732
Light's Noises, Scientists Listen to..... 454
Lights of Girard College, Tower..... 347
Lights, Regulator for Street Car..... 128
Lights Send Children Home..... 1045
Lights, The Proper Placing and Shading of..... 1084
Lights, Turning Down Electric..... 769
Lighter for Auto Gas Headlights..... 729
Lighter, How to Make and Electric Gas 92
Lighting as an Art..... 755
Lighting Cables in Japan, Laying..... 534
Lighting Circuits, Electric..... 386
Lighting, Effective Night Billboard..... 694
Lighting Effects, Past and Present..... 257
Lighting, Electric Farm..... 431
Lighting Fixtures Part of Piano..... 572
Lighting, Fortuny Stage..... 341
Lighting Hints, Bank..... 491
Lighting in Arabia, Electric..... 711
Lighting in New York, Thirtieth Anniversary of Electric..... 680
Lighting in a Pumping Plant, Economical 1187
Lighting of Cafes, The..... 1084

	Page
Lighting Plant, Windmill Farm	655
Lighting Rows of Shelves	731
Lighting, Suggestions in Scale	485
Lighting Switch, Automobile Door	1269
Lighting the Bastile Column	1182
Lighting the Track Ahead	637
Lighting Without Glare, Picture	672
Lighthouby Tender, The Sun as	1178
Lighthouse, Hornum	1152
Lighthouse Tended from the Shore	547
Lightship, The Ambrose Channel	75
Lightning and Petroleum	885
Lightning Arrester in the World, Largest	158
Lightning Arrester, Mercury	461
Lightning Bores Iron	520
"Lightning Bugs," Record Run of the	41
Lightning, Curious Fact as to	908
Lightning, Curious Features of	857
Lightning, Cylindrical	956
Lightning Discharges from Kites	1323
Lightning Display at Mt. Taal	352
Lightning in Cities, Safety from	1277
Lightning, Pearl	899
Lightning, Protecting Nitro-Glycerin Works from	756
Lightning Rods to Protect Threshing Machines	926
Lightning Rods, Washington Monument's	427
Lightning, Train Struck by	335
Lightning, Uncle Sam Investigates Electrical	1046
Limousines, Auristophone Annunciator for	360
Line Patrolman and His Home	959
Line Wires, Deadening the Hum of	299
Lineman's Aerial Car	1303
Linemen at Work in the Rugged West	428
Linemen, New Torch for	1362
Lines of Force, Energy from the	585
Linguist Operators	45
Linking the Links of the Long Distance "Phone"	670
Liquid Air and Magnetism	1274
Liquid Condenser, A	856
Lives of Little Children, Safeguarding the	253
Location of Electric Heaters, The	668
Location Board, Car	1072
Lock and Alarm, Wood Chest	1274
Lock, Time Recording	90
Locks Lamp in Socket	58
Locking Up Lamps to Prevent Theft	1048
Locomotive That Hauls Its Own Power	51
Locomotives, Electricity Ousting the Steam	1009
Logging by Electricity	1310
London, Double Deck Electobus in	111
London, Gasoline-Electric Omnibuses in	747
London Nerve Shatterers	1054
London Postal Subway, Proposed	202
London Railway Electrification	1252
London's "Human Sleepers"	645
Lonely Cable Station in Mid-Pacific, A	316
Long Cord Turn Down Lamp	268
Long Distance 'Phone, Linking the Links of the	670
Long Distance Telephone, Hints on Using the	1048
Long Distance Wireless Rrecord from Persia	747
Long Distance Wireless Operations, Germany's	262
Long Distance Work, Hook-up for	190
Long Run of an Electric Car	943
Longest Nickel Street Car Ride	263
Longitude by Wireless, Determining	620
Loom in Place, Keeps the	391
Looping the Loop	54
Lord Kelvin, Presentation of Bust of	340
Los Angeles Water from Beyond the Mohave	513
Lost Radium, Search for Particle of	817
Loud Speaking Telephone at Ball Games	935
Loud Speaking Telephone for the home	643
Loud Speaking Telephone, Ventriloquism and the	1323
Low Aerials for Wireless	1252
Low Voltage Electric Lighting (Book Review)	100
Low Voltage Transformer, Variable	977
Lumber Mill	334
Lumber Mills, Monorail System for	148
Luminous Arc Lamps, Ornamental	543
Luminous Electric Radiator	952
Luminous Goblet, The	230
Luminous Marble Walls	772
Lure of Beauty, The	64

M

	Page
Magic Buzz Saw, The	475
Magic Toboggan Slide, The	182
Magna Lamp Adjuster	694
Magnaphone, The—Something Really New	808
Magnet Bill	1319
Magnet, Capacity of a Lifting	729
Magnet, The	737
Magnetic Action, Experiments in	1273
Magnetic Attraction and the Compass	1322
Magnetic Chuck	571
Magnetic Detector, The	184
Magnetic Metals, New Discoveries Regarding	397
Magnetic Navy, A	1089
Magnetic Needle, Columbus and the	1087
Magnetism and Liquid Air	1274
Magnetism and Petroleum	807
Magnetism, An Interesting Experiment in	373
Magnetism on Watches, Effect of	1279
Magnetism, Pressing Clothes by	362
Magnetized Borers	1087
Magnetized Floor, Walking on a	155
Magneto Doorbell, A	361
Magneto, To Make a Small	281
Magnet, Slater's Tank	141
Mail Box Alarm	980
Mail Carrier, An Electric	1299
Maintenance and Lamp Trimming, Electric Car for	934
Making Glass Threads	860
Making of an Engineer, The	683
Making Salt from Sea Water	1016
Making Sugar by Electricity	869
Mammoth Bouquet Advertises Electric	770
Man Behind the "Movies," The	955
Manila, Handling a Carnival Crowd in	1227
Manila's New Hotel	941
Manojlovac Plant in Austria-Hungary, The	220
Manufacturer, Edison as a	625
Manufacturers, Edison Among the Great	749
Manuscripts with Ultra-violet Rays, Deciphering	243
Map Making with the Aid of Wireless	748
Marble Quarry, Electricity in a	209
Marble Walls, Luminous	772
Marconi	213
Marconi Company, Judgment for the	1357
Marconi Contract with British Government	298
Marconi, Guglielmo	233
Marketing by Telephone	576
Marshmallow Roast, A	576
Masked Ball, Telephone Features at a	53
Master Organ Builder, The	1050
Mat Signals Elevator, Stepping on	787
Matter of Achievement, A	886
Matthew C. Brush	168
Maxims Collision Preventer, Sir Hiram	619
Mayor of Wheeling in His Decorated Electric	419
McKibben, Frank C	552
McMeen, Samuel Groenendyke	269
Measurement of Water Flow	1111
Measurements, Refinement of Electrical	202
Measures Cost of Operation	820
Measuring Temperature from a Distance	1199
Measuring Temperatures with an Electric Thermometer	35
Measuring the Flow of Large Streams	43
Measuring Wind Velocity	943
Meat Cutter, Electric	459
Meat Slicing Machine for Butchers	1003
Mechanical Refrigeration	372
Medal, Rathenau	1159
Medals, Award of American Museum of Safety	1270
Medicine, Metallic Colloids in	356
Medicine, The Quartz Mercury Lamp in	313
Mellow Light, A Cheap	201
Memorandum Pad, Light for	572
Memorial, College Class Leaves	1294
Memorial Library, Harper, University of Chicago	737
Memorial to Phillips of the Titanic	995
Memory, Electricity and	397

	Page
Mental Character Determined by Machine	72
Men Who Follow the Law of Ohm	115
Men Wonder at New Audit Machine	564
Merhant Ship Searchlight, Most Powerful	662
Mercury Lamp in Medicine, The Quartz	313
Mercury Lamp, Natural Light for	768
Mercury Lamp, White Light from the	1122
Mercury Lightning Arrester	461
Mercury, Searchlights that Float in	993
Metallic Filament, Effects of	787
Metallic Telephone Circuit, The First All	1014
Metal, Receiver Casings of	491
Metals, New Discoveries Regarding Magnetic	397
Metals, The Evaporation of	917
Metals with Lead, Coating	301
Method of Suspending Aerial, Novel	384
Meteor, The Power of a	1222
Meter, A Hot Wire	80
Meter, Energy-Cost	820
Meter for Electrics, Ampere Hour	566
Meter, Householders Know Your	86
Metropolitan Mining by Electricity	47
Mexico City, Signs Needed in	877
Mexico, Two Great Scenic Railways of	1060
Microradiographs	1162
Microscopic Objects, Photographing	1255
Microtelephone, Le Nouene	125
Mid-Pacific, A Lonely Cable Station in	316
Midnight Ride of 48-Ton Generator	954
Midway Island	316
Milking Cows in the Pasture	562
Milking Machines, Motor Driven	568
Milkman, For the	493
Milk Warmer, Electric	577
Mill Mountain Incline	643
Mill Pond, Fishing in the Old	98
Mine, Aerial Trams of a Utah	254
Mine Alarm	693
Mine Mules and the Trolley Wire	409
Miners' Electric Lamp, German	1320
Mines, American Equipment in Japanese	915
Mine Signal, An Old-Time	433
Mineralized Carbon Lamp Electrodes	1153
Miners' Electric Safety Lamps	1034
Mines, Air Humidifier for	1134
Mines Turned Into Gas Retorts, Coal	413
Mine Telephone, Saving	38
Miniature Elevator Displays Shoes	735
Miniature Lamp Letter Sign	440
Miniature Motion Picture Machine	136
Miniature Pleasure Park, A	279
Miniature Railway in a Steel Plant	1032
Mining by Electricity, Metropolitan	47
Mining Machines in Australia, Coal	922
Mining, Pitchblende	54
Minneapolis, Electrical Developments in	542
Minor Surgery, Adapting the X-Ray to	169
Mission Street Light Fixtures	468
Missoula's Lane of Light	1213
Missouri, Pumping Barges on the	33
Mississippi Power Development	451
Mystery, Book of	981
Model Electrically Driven Shop	583
Model Power Plant, A	375
Modern American Telephony (Book Review)	100
Modern Bioscope Operator, The (Book Review)	396
Modern Concrete Home, The	1043
Modern Dusting	1345
Modern Hotel, Electric Cooking in a	704
Modern House with Vacuum Cleaner	270
Modern Illumination (Book Review)	748
Modern Interurban Stations	1295
Modern Sculptor, The	162
Modern Underground Work	1041
Modern Water Wheels, From Ancient to	344
Mohave, Los Angeles Water from Beyond the	513
Mohawk Valley, The Wonder Work of the	1018
Moissan's Furnace, Prof	637
Moisture Regulator for Rooms	59
Money Counting Machine	1272
Money Earned from the Telephone, First	245
Money-in-the-Slot Restaurant	1185
Money Laundering Machines, The Perfected	250
Monoplane, Wireless on	526
Monorail System for Lumber Mills	148
Montana, Copper Refining Plant in	1287
Montreal, Unloading the Ships at	60
Most Powerful Merchant Ship Searchlight	662
Mothers, Just Plain	471
Moths, Destroying the Browntail and Gypsy	669
Motion Picture Handbook (Book Review)	300
Motion Picture Machine, Miniature	136
Motion Pictures	1203
Motion Pictures, Talking	1204
Motor, An Adaptable Small	821
Motor and Brake Attachment for Sewing Machines	1373
Motor, A Static	182
Motor, A Versatile Small	1220
Motor Boat Ignition	1101
Motor Boats, Telephone in Timing	22
Motor, Box Cars Loaded by	1285
Motor Car, A German Wireless	716
Motor Cars, Gasoline-Electric	1380
Motor Cars, Telephone for	688
Motorcycle and the Trouble Shooters	773
Motor Driven Grinder	187
Motor Driven Hack Saws	1385
Motor Driven Milking Machines	568
Motor Dust-Proof, Making a	873
Motor, European Farm	165
Motor Holster	485
Motor, Jeweler's Power	267
Motorist Shall Wear, What the	276
Motorman and Dispatcher, Signaling Between	914
Motor Operated Bell	197
Motor, Portable Polishing and Grinding	458
Motor Pump, Reciprocating	459
Motors, Early Electric	1387
Motors Speed Up, Why Shunt	1240
Motor, Treadle Controls the	265
Motorman Warm, Keeping the	733
Motor Starter, Flywheel	1382
Motor, Women and the Electric	469
Motors in the Quarrying of Sandstone	797
Motors in Track Switching, Electric	1169
Motor Operates Model, Electric	363
Motor Over 20 Years Old	556
Motor, Reversing Switch for Small	863
Motor Speeders, Warning to	1130
Motor to the Work, Taking the	1132
Motor, Dry Thermoses, Electric	873
Motors, Wave	1124
"Motion Picture Work" (Book Review)	1125
Mountain Breezes by Wire	470
Mountaineering in an Electric	936
Mount Washington Cog Railway Up	658
Mount Wilson Observatory	1184
Mouse Carries Thread Through Pipe	132
Mouse Ties Up Street Car System	920
Movable Laboratory for Air Surveys	925
Movies, The Man Behind the	955
Moving Headlights Window Attraction	735
Move in the Right Direction, A	1388
Moving Panoramic Sign	1111
Moving Picture Attraction, Wireless Outfit as	1355
Moving Picture Machine for the Home	1381
Moving Picture Machine, Improved Carbon Holder for	982
Moving Picture Machines, Improvement in	200
Moving Pictures by Incandescent Lamp	1259
Moving Pictures, Convicts See	1092
Moving Pictures Flickerless	1320
Moving Pictures for the Blind	796
Moving Pictures, How They Are Made (Book Review)	300
Moving Pictures of Bullets	786
Moving Pictures, Shooting at	644
Moving Picture Theater, Behind the "Scenes" in a	1036
Moving Picture Theater in Trolley Car	351
Moving Power Plant, Electric Truck as a	1322
Mr. Flannerty Goes Hunting	826
Mt. Taal Eruption, Electrical Display Accompanying	352
Mt. Washington, Electric Line Up	454
Mules and the Trolley Wire, Mine	409
Multiple Rotary for Windows, Invisible	736
Municipal Kitchen, A	1379
Museum-Circus Train, Electric	924
Music, Electrical	803
Music, Illuminated	535
Music Teacher, Electric	1350
Mystery, The Blue Room	1280
Mysterious Skeleton, The	1374

N

Page

Nail, Insulating 1361
Naples Deep Running Subway..... 202
National Electric Light Association..... 115
National Electric Light Association, Brief Sketch of the..... 116
National Electric Light Association at Seattle 305
Native Telegrams in China..... 1087
Natural Light for Mercury Lamp..... 768
Naval Electrician, The Making of the.. 410
Navigation on the Panama Canal, Aids to 938
Naval Training Station, The Great Lakes 522
Naval Vessel, Our First Electrically Driven 778
Navy, A World Wireless System for Uncle Sam's 712
Navy, A Magnetic..... 1089
Navy Equipment, High Power..... 190
Navy to Report Positions, Ships of..... 81
Navy Wireless Station at Arlington..... 190
Navy Yard Wireless Training Station, Brooklyn 478
Needle, Death From an Improvised Electric 439
N. E. L. A. Past Presidents of..... 118
Neon—A New Element With a Future.. 1054
Neon and Electric Waves..... 749
Nernst Lamp 299
Nerve Shatterers, London..... 1054
Network, Protectors of the..... 1108
"New Attitude" Toward Disease, Electricity and the..... 579
"Newdisco" Washing Machine..... 177
News for Desolate Islanders, Wireless.. 81
New York Clubs Form Relay..... 1357
New York From the Catskills, Bringing Water to 416
New York Horse Car in Snow Storm.... 1351
New York Telephone Directories..... 837
New York, Thirtieth Anniversary of Electric Lighting in..... 680
New York's Double Deck Stepless Car... 527
New York's Electrical Fourth..... 432
New York's Grand Central Terminal.... 1137
Niagara Falls, Coal Equivalent of..... 773
Niagara Falls, Illumination of..... 673
Niagara Falls, The Ontario Power Plant at 815
Niagara Power, Canadian Farmers Use.. 1161
Nice, Carnival at..... 350
Nice, Electrical Pageant at..... 350
Nickel Street Car Ride, Longest..... 263
Night Billboard Lighting, Effective..... 694
Night, Playing Tennis at..... 520
Night Ehipwrecks, Head Lights for Victims of 258
Nile, Harnessing the 1318
Nitrogen Atom, Pursuit of the..... 1035
Nitrogen, Dr. Eyde's Work in Electrical Production of 741
Nitro-Glycerin Works, Protecting from Lightning 756
Nobility and His Electric Auto, One of the 374
Noise Indicator, Nursery..... 909
Noodle Makers, The Chinese..... 806
Norway, Electric Steel Production in... 619
Norway, Electrolytic Copper Refining in 937
Novel Use of Electric Current..... 960
Number Signs, New System of Electric.. 1006
Nursery Noise Indicator..... 909

O

Observation Tender for Submarines..... 248
Observations at a Household Show..... 272
Observatory, Mount Wilson..... 1184
Ocean Waves, Power From the..... 202
"Oceanic Letter," The..... 508
Octophone, The..... 1383
Odd Effects of Electric Currents..... 816
Oddities, Electrical..... 1279
Of Interest to Elks 1061
Office Bell 1241
Office Convenience, An..... 1131
Office Ventilator, An..... 1005
Ohio Electric Light Association..... 452
Ohm, Men Who Follow the Law of..... 115
Ohms, The Bothersome..... 1285
Oil Cup Is Empty, When the..... 95
Oil Fields, Electric Drilling in the..... 1209
Oil From Condenser Water, Removal of 982
Oil Lamp, Combination Electric and..... 996

Page

Old Carbon Ends, Using..... 87
Old-Time Mine Signal, An..... 433
Omnibuses in London, Gasoline-Electric 747
One of the Pioneers..... 556
One-Way Telephone, To Make a Simple.. 730
Ontario Power Plant at Niagara Falls.. 815
Opaque Objects, Projecting Images of... 933
Open Circuit Telegraph Line..... 983
Open Door Alarm..... 729
Open Wiring in Concrete Buildings, Supporting 730
"Opera Stories" (Book Review) 1381
Operator, How to Become a Telegraph.. 154
Operators, Advice to..... 45
Operators, Linguist 45
Opportunity, Getting Ready for the..... 739
Opportunities of the Electrical Store Window 817
Orchestra, The Unit..... 49
Ordering Device for Restaurants, Electric 619
Ordinance, Freak 899
Ordnance Manufacturing in Russia..... 1252
Ore Finding by Electricity in Wales.... 313
Organ Builder, The Master..... 1050
Orme, Electricity Conquers the Welsh... 433
Ornamental Luminous Arc Lamps..... 543
Osmose in the Drying of Peat, Electric.. 861
Outdoor Electric Advertising..... 445
Outdoor Elevator, An..... 136
Outlets, Dining Table..... 1241
Out-of-the-Way Corner for Effective Display Space, Utilizing an..... 740
Output Curve, The Weather and the.. 1284
Overhead Construction in France..... 896
Ozonator, The..... 1384
Ozonator, Household 367
Ozone for Sterlizing Barrels..... 996
Ozone in Tunnels of Central London Railway 1300
Ozone Purifying System a Success in St. Petersburg 873

P

Pacinotti, Prof Antonio..... 146
Paint Train, A..... 908
Packing, A Galvanic 293
Packing, A Galvanic..... 923
Packing, To Prevent a Transmitter from 485
Paddle Wheels Open and Close Bridge. 519
Palace Garden Electrically Decorated.. 325
Palace of India, Electric Cooking in a.. 1342
Palace of Light at Ghent..... 1252
Palmer, Ray 365
Panama-California Exposition, Electricity Building at..... 1180
Panama Canal, Aids to Navigation on the 938
Panama-Pacific Exposition 1194
Panoramic Sign, Moving..... 1111
Paper Drier for the Job Printer..... 167
Paper Drill with Adjustable Table..... 695
Parade for the Shriners, Electric..... 262
"Paragele" to Frighten Hailstorms..... 768
Parcel Post, Underground Transportation for 1170
Paris Duelling School, A..... 211
Paris, Electric Refuse Wagons of..... 244
Paris Engineer's Odd Dining Room Railway 76
Paris Fire Fighters..... 636
Paris, Illuminations of One of the Large Fountains in the Place de la Concorde 264
Paris Subway, Unusual Feature of..... 156
Park, A Miniature Pleasure..... 279
Pasadena, Artistic Rest Stations in..... 444
Past Presidents of the N. E. L. A..... 118
Patents, Inventions and..... 395, 503
Pathfinders of the Wires, The..... 428
Patrol Boat No. 2, Chicago's New Police 557
Patrolman and His Home, Line..... 959
"Peace Palace" at Washington, Fountain of the 906
Pearl Lightning 899
Peat, Electric Osmose in the Drying of 861
Peat, Electricity from..... 125
Peat Fields of Bavaria..... 394
Pekin, Telephone Service in..... 618
Pekin, 6,500 Telephones in..... 993
Pencil Holder, Electric..... 268
Pencil, The Wizard Lead..... 959
Pennsylvania Farm Electrified, A..... 138
Perfumer and Disinfector, Electric..... 1004
Periodograph, The 691
Permanence of Colors, Testing the..... 866
Permanent Hair Waver, The..... 1216

	Page
"Perpetual Motion" Sign	21
Persia, Long Distance Wireless Record from	747
Petroleum and Magnetism	807
Petroleum, Lightning and	885
P. E. Wireless Club Member in South Africa	1097
Pews, Electric Heaters for Church	745
Philadelphia Rapid Transit Co., Freak Ordinance	899
Philip Stephens Dodd	824
Philippines, Cooking in the	581
Philippines, Why Conduits Are Necessary in the	654
Phillips, "Jack," Wireless Operator on the Titanic	214
Phillips of the Titanic, Memorial to	995
Phonograph, Aeroplane	1017
Phonograph as an Automobile Alarm, The	315
Phonograph, Giant	772
Phonograph Music Transmitting	562
Phonograph with Electric Brake	255
Phonographs and the Man That Invented Them	105
Photograph of a Rotary Spark Discharger	480
Photographs Over Wire, Sending Colored	1254
Photograph, To Take Your	1222
Photographic Machine, Coin Operated	1135
Photographing Birds	858
Photographing Books by Electricity	260
Photographing Microscopic Objects	1255
Photographing Yourself	866
Photography, Arc Lights and High Class	1040
Photography, Combination Lamp for	601
Photography, Electric	249
Photo in One Minute, Dime in the Slot and	42
Photo-Electric Cells	1112
Photo-Telegraph, A Portable	1306
Photometer, A Simple	295
Physician's Electric Cabinet	662
Piano, Coin Operated	56
Piano Lamp, A	494
Piano, Lighting Fixtures Part of	572
Piccirilli, Joseph	162
Picture Lighting Without Glare	672
Picture Projection, Methods of	55
Picture Sending by Wire	240
Picture Sending, Wireless	693
Pictures by Incandescent Lamp, Moving	1259
Piecing Out Daylight to Hasten Plant Growth	1175
Pig, Roast You, Mr.	581
Pile Driver, An Odd	236
Piling, Floating Power Plant Protects	142
Pilots of the Night, Searchlight	146
Pioneers, One of the	556
Pipe, Mouse Carries Thread Through	132
Pipes, Thawing Frozen Water	1137
Pisa, Leaning Tower of	137
Pistol, Searchlight Attachment for	1176
Pitchblende Mining	54
Pitchers Tested by Electricity, Speed of	1090
Place de la Concorde, Paris, Illuminations of One of the Large Fountains in the	264
Placing and Shading of Lights, The Proper	1084
Placing Platinum Wire in Quartz Tubes	393
Plain Mothers, Just	471
Plan for Canvassing Election Returns, Efficient	646
Plans and Specifications for Wireless Telegraph Sets (Book Review)	505
Plans to Outdo the Eiffel Tower	1042
Plant Growth, Piecing Out Daylight to Hasten	1175
Plant Growth, Radium and	1253
Plant in the Bush Land, A	944
Plant, Strange Electric Battery	756
Plants and Electricity, Growing	1388
Plate Printing, A Revolutionary Improvement in	1255
Plater's Tank Magnet	461
Plate Warmers, Electric	177
Platinum Wire in Quartz Tubes, Placing	393
Playing Tennis at Night	520
Pliers Made from Fiber	201
Plug, Emergency Extension	1256
Plug, Water-tight Receptacle and	860
Pocket Storage Battery Voltmeter, A	94
Poincare, Henri	619
Pole Holes with Dynamite, Digging	502
Pole Lines, Alley	518
Pole Setting	1002
Poles Molded in Sections, Concrete	1150
Pole, The Rotating Barber	100
Police Call System	1201
Police Patrol Boat No. 2, Chicago's New	557
Policeman's Club, Flashlight in	521
Polishing and Grinding Motor, Portable	459
Polishing Machines, Dust Collector on	59
"Polychrome" Lamp, A	266
Pond, Fishing in the Old Mill	98
Popular Electricity Magazine's Sworn Statement	876
Porcelain, Electro-Plating on Glass and	199
Portable Egg Tester	983
Portable Flashlight Apparatus	695
Portable Floor Light	924
Portable Grinder	167
Portable Photo-Telegraph, A	1306
Portable Polishing and Grinding Motor	458
Portable Power Plant, Doctor's	1379
Portable Power Table, The Household	176
Portable Pump for Fire Fighting and Irrigation	364
Portland Regrade Operation	153
Portland Rose Festival	342
Portable Searchlight, Fishermen's	1133
Portable Safety Electric Lantern	264
Portable Set, Detector for	844
Portable Street Light	391
Port-A-Lite, The	470
Possibilities of Trade with India	1127
Postal Subway, Proposed London	202
Postcard Pictures, Projecting	183
Potassium, Radiation from	1197
Pottery Designs for Lamp Bases	251
Powder Exploding Box	310
Power Behind the Phone, The	760
Power Driven Hedge Trimmer	1386
Power from the Ocean Waves	202
Power House from the Ice, Saving a	355
Power in Time of Strikes, Central Station	203
Power, Locomotive That Hauls Its Own	1041
Power Motor, Jeweler's	267
Power of the Columbia, Utilizing the	1310
Power of a Meteor, The	1222
Power Plant, A Model	375
Power Plant, Doctor's Portable	1379
Power Plant, Electric Truck as a Moving	1322
Power Plant Protects Piling, Floating	142
Power Project Near Completion, Huge African	1380
Power Table, The Household Portable	176
Powerful Incandescent Lamps	866
Powerful Merchant Ship Search light, Most	662
Practical Engineer, The	810
"Practical Mathematics" (Book Review)	1381
Practical Workers, Elementary Electricity for	1364
Precious Gems and Electro-Chemistry	1275
Precious Stones, X-rays in Testing	264
Preferred Stock, Cumulative	1120
Presentation of Bust of Lord Kelvin	340
Pressing Clothes by Magnetism	362
Pressing-Iron Economy	1004
Preventing Gravity Cels from Creeping	391
Prevention of Hail	519
Principle of Electric Cooking, Fundamental	72
Printer, Paper Drier for the Job	167
Printing, A Revolutionary Improvement in Plate	1255
Printing Frame, Retouching and	359
Prison, An Electrical Genius Released from	241
Private Exchange Board, Hotel Clerk's	1242
Private Garages, Current Converter for	56
Proctor Theater Sign in New York, The Great	415
Production of Hydrogen, The	397
Production of Nitrogen, Dr. Eyde's Work in Electrical	741
Professor's New Battery, Danish	508
Professor Moissan's Furnace	637
Profuse Light Pays the Jeweler	805
Progress of Physics, The (Book Review)	505
Projecting Images of Opaque Objects	933
Projecting Postcard Pictures	183

	Page
Projecting Sign, An Immense	23
Projection, Four Methods of Picture	55
Projector, Victor Postcard	183
Projectoscope	55
Promptness of American and English Telephone Operators Compared	264
Propeler Operates Window Display, Aeroplane	98
Propulsion for Lake Boat, Electric	656
Proposed Atlantic Weather Bureau	715
Prospecting by Electricity	313
Protect Life, White Lines to	1318
Protecting Nitro-Glycerin Works from Lightning	756
Protectors of the Network	1108
Providing Pure Air in Telephone Vault	463
Proving the Engineer Alive	149
Public Entertaining Revolutionized	1202
Public Unfamiliar with Coal	111
Public's Ribs, Tickling the	347
Puff Iron, Electric	1386
Pull Chain Adapter, A	426
Pullman Automobile Has Arrived, The	771
Pull Switch, Wall	569
Pulmoter, The	20
Pulmotor Practice, Classes in	1205
Pump, Automobile Tire	1259
Pump for Fire Fighting and Irrigation, Portable	364
Pump, Reciprocating Motor	459
Pumping Barges on the Missouri	33
Pumping Outfit, Emergency	558
Pumping Plant, Economical Lighting in a	1187
Pumping Plants, Electric	124
Pumpkin, The Talking	1374
Pupils, Rural School	1388
Pupin's Life, Turning Point in	869
Puppies Appreciate Warming Pad	929
Purging of Raw Gold, The	774
Pursuit of the Nitrogen Atom	1035
Push Button, Indicating	732
Putting the Lead Sheaths on Cables	1068
Puzzle: Find the Motor	21
Pyrenees, Electric Conquest of	771
Pyrometers	34

Q

	Page
Quad Electric Stove and Fireless Cooker	699
Quart of Water Equals a Horse Power of Electricity, Where	881
Quarrying of Sandstone, Motors in the	797
Quartz Working	653
Quartz Lamp	243
Quartz Lamp Installation in This Country First	635
Quartz Lamp, Uviol	313
Quartz Mercury Lamp in Medicine, The	313
Quartz Tube Lamps, New Way of Making	746
Quartz Tubes, Placing Platinum Wire in	393
Quartz Vaporized	1317
Questions and Answers in Wireless 82, 287, 383, 481, 594, 966,	1098
"Questions and Answers On the National Electrical Code." (Book Review)	1125

R

	Page
Rackets Courts, Special Illumination of	803
Radiation from Potassium	1197
Radiators in Bears' Dens, Electric	111
Radium, A Test for	335
Radium and Plant Growth	1253
Radium Bathers, Hotel for	408
Radium Baths in Bohemia	69
Radium, Explosion of	667
Radium in the Air	337
Radium in Yellowstone Park	1148
Radium, New Way of Using	745
Radium Rays from Gas Mantles	507
Radium Rays in Coloring Gems	541
Radium, Search for a Particle of Lost	817
Radio-Automatic Torpedo, The	1093
Radio-Operation, Regulation of Amateur	287
Radio-Telegraphy in Time Regulation	497
Radiographic Laboratory, Dr. Infroit's	1151
Raft, Novel Life	1143
Rail Joint, New	1337
Rails, Grinding Down the	45
Railless Electric Traction in Dundee	1067
Railroad Clocks by Wireless, Setting	1096
Railroad Signal, Electrical	506
Railroad Teegraph School, A	54
Railroads of a Whole Country, Electrifying the	803
Railway Conquest of the World, The (Book Review)	100
Railway Electrification, London	1252
Railway for Trolley Cars, An Elevated	1309
Railway, Hamburgs New	329
Railway in a Steel Plant, Miniature	1032
Railway, Ozone in Tunnels of Central London	1300
Railway, Paris Engineer's Odd Dining Room	76
Railway Station, Labeling Seattle's	769
Railway Up Mount Washington, Circular	658
Railways, Weed Burners on Electric	905
Railway Without a Trolley, Electric	934
Rain, Eelectric Charge on	1294
Rain Maker, A California	958
Ramsay, Sir William	754
Rat Trap, Electrical	1363
Rates Defined, Electric Current	686
Rat's Handiwork, A	149
Rathenau Medal	1159
Ray Palmer	365
Ray, The Revealing	1163
Razor Blade Sharpener, Demonstrates Safety	497
"Readiness to Serve"	1069
Receiver Casings of Metal	491
Receiving Stations on the Ground	1231
Recipe Box Aid to Housewife	1218
Reciprocating Electric Drill	55
Reciprocating Motor Pump	459
Recognition of Faithful Friends, In	1174
Record Run, Electric Truck Makes	143
Record-Breaking Reel of Wire	897
Recording Eclipse with Selenium Cell	449
Recording Lock, Time	1274
Recorder, New Telegraph	1253
Rectifier	586
Rectifier, The New Edison	358
Rectifier, Vibrating	1135
Rectifying Nets	689
Reel of Wire, Record-Breaking	897
Refinement of Electrical Measurements	202
Refining Plant in Montana, Copper	1287
Reflecting Heater, A	823
Reflector, Adjustable	693
Reflector and Window Sign, Combined	1322
Reflector, Chopping Bowl	981
Reflectors, Cleaning of Bulbs and	72
Refrigeration, Mechanical	372
Refrigerating and Ice-making Plant, Home	172
Refrigerating Machine, Andiffren	457
Refrigerator for Milk	493
Refuse Wagons of Paris, Electric	244
Regrade Operation, Portland	153
Regulating Socket, A	1008
Regulation of Amateur Radio-Operation	286
Regulator, Automatic Temperature	164
Regulator for Rooms, Moisture	59
Regulator for Street Car Lights	127
Relay, New York Clubs Form	1357
Relic of the World's First Central Station, A—Jumbo	1030
Religion Advertising	53
Reminder Clock	267
Remodeling Fire Engines for Electric Propulsion	252
Remote Places of the Earth, Building the Trolley in the	1144
Removal of Oil from Condenser Water	982
Removing Top Soil by Electric Power	1305
Repair Shop on Wheels, Army	1031
Repair Wagon, Searchlight for	158
Repeater, A Telephone	993
Rescue, Flashlight Protects Night	18
Research, in Electricity	773
Resistance, "Freezing Out" the	46
Resistance Thermometer, How to Make	388
Resistance Unit, Instructor's Variable	1320
Resistances at Very Low Temperatures, Electrical	921
Respirone, The	1386
Rest Stations in Pasadena, Artistic	444
Restaurant, Money-in-the-Slot	1185
Restaurant, Sign for a	99
Restaurants, Electrical Ordering Device for	619
Restoring Old Hard Rubber to Its Natural Color	82
Resuscitation Committee, Rules Recommended by	414

	Page
Retouching and Printing Frame	359
Return Call Button Hides Call Bell	268
Revealing Power of Light	1176
Revealing Ray, The	1163
Reversing Switch	92
Reversing Switch for Small Motor	863
Revolution, The Domestic	1344
Revolutionary Improvement in Plate Printing, A	1255
Revolving Turntable for Window	297
Rheostat, Adjustable Water	291
Rhone, Damming the Historic	507
Rice, A New Series by Archie	101
Riddling Sand by Electricity	361
Ride of 48-Ton Generator, Midnight	954
Ries System, Semaphore Signals by	735
Rifle, A Searchlight for the	413
Ripening Walnuts by Electricity	111
Rivadavia—The Great Argentine Battleship	1149
Road Over the Alps, A New	620
Roadside Telephones in England	535
Roadway, Hydro-Electric Dam Surmounted by a	825
Roast Young Pig	581
Robert F. Pack	942
Rolling Auto Tire, The	496
Romance of Modern Electricity, The (Book Review)	300
Romance of Wireless, The	233
Roof Wiring, High Tension	1206
Rose Festival, Portland	342
Rosette, Ceiling	197
Rosette, Shock Absorber in a	197
Rotary for Windows, Invisible Multiple	736
Rotary Spark Discharger, Photograph of a	480
Rotating Barber Pole, The	100
Rotating Spiral, The	1197
Rotation Experiment, Electro-Magnetic	473
Roulette Wheel, The Crookedest, Costliest	1327
Roundabout, Aeroplane	541
Rows of Shelves, Lighting	731
Royalty at the Aldershot Experiments, English	335
Rubber, Artificial	298
Rubber Came Into the Electrical Industries, How	1066
Ruby Lamp	391
Rubber to Its Natural Color, Restoring Old Hard	82
Rubber's Secret Conquered	530
Rules Recommended by Resuscitation Committee	414
Runabout, Smallest Electric	268
Rural School Pupils	1388
Rush and Slack Hours in a Telephone Exchange	312
Russia, Ordnance Manufacturing in	1252
Rutile	1305

S

	Page
Safe Expert Uses an Electro-Magnet	11
Safeguarding Sea-Travel, Electricity's Part in	401
Safeguarding the Lives of Little Children	253
Safe Opened With a Tuning Fork	1198
Safe Temporary Wiring	86
Safety Device, An Ingenious	980
Safety Device, Street Car	941
Safety Electric Lantern, Portable	264
Safety from Lightning in Cities	1277
Safety Lamps, Miners' Electric	1034
Safety Razor Blade Sharpener, Demonstrates	497
Safety Switches on Old Seventeen Mile Grade	1319
Sailors for Wireless, How Uncle Sam Trains His	478
Salt from Sea Water, Making	1016
Samuel Groenendyke McMeen	269
Sand by Electricity, Riddling	361
Sandstone, Motors in the Quarrying of	797
San Francisco Hears Wireless from Korea	189
San Francisco's Electric Service	1269
Sanitary Strap for Street Cars	883
Saute Pan, Electric	952
"Save a Dollar" Window	985
Saved by the Mine Telephone	38
Saving a Power House From the Ice	355
Saving Lamp Carbon Stubs	664
Saving the Fur Seal Mother	894
Saw, A "Walking"	60
"Saw Filing and Management of Saws." (Book Review)	1254
Sawing Down Trees	1073
Sawing Machine, Electric Wood	688
Sawing Through Steel	52
Saw, Motor Driven Hack	1385
Saw, The Magic Buzz	475
Scale Lighting, Suggestions in	485
Scandinavian Countries, Telephones per Capita in	747
Scarecrow, An Electrical	565
Scenic Electric Railway Up Mt. Washington	454
Scenic Railways of Mexico, Two Great	1060
School, A Railroad Telegraph	54
School Children, Tesla's Plan of Electrically Treating	813
School for Telephone Operators, First	919
School Pupils, Rural	1388
Scientists Listen to Light's Noises	454
Scott, A. C.	446
Scratch Pad, Telephone	572
Scrubbing Machine, An Electric	460
Scrubbing, Up-to-date	310
Sculptor, The Modern	162
Sculpture, Electricity in	163
Sea, Electricity from the	1125
Sea Water, Making Salt from	1016
Seal Mother, Saving the Fur	894
Sealing Room, Fans for	294
Sealing Wax Heater	1131
Sealing Wax Melter	57
Search for Particle of Lost Radium	817
Searchlight Advertising in Baltimore, Novel	420
Searchlight Aiming Device	884
Searchlight Attachment for Pistol	1176
Searchlight, Deep Sea Fish Carries a	785
Searchlight for the Rifle, A	413
Searchlight, Fireboat, Electric	759
Searchlight, French Automobile	1064
Searchlight, Frightening Badgers With a	159
Searchlight, General Utility of the Modern	1006
Searchlight, Most Powerful Merchant Ship	662
Searchlight on Repair Wagon	158
Searchlight Pilots of the Night	146
Searchlight, Shooting by	559
Searchlight Signalling Apparatus on Board a Warship	400
Searchlight, Troublesome, Portable	1183
Searchlights that Float in Mercury	994
Seasoning of Wood, Electric	1077
Sea-Travel, Electricity's Part in Safeguarding	401
Seattle, Electrical Development in and About	305
Seattle Mills, Electricity Cheaper Than Steam in	140
Seattle's Railway Station, Labeling	769
Seaweed, Insulation from	345
Securities, Electrical 30, 133, 237, 330, 499, 615, 742, 870, 989, 1115, 1246,	1375
Secrets of Electrical Stagecraft, Some 13, 222, 422,	548
Selenium Cell, Recording Eclipse with	449
Selenium, Experiments with	1303
Self-Starter, Automobile	1001
Self-Starting Gasoline-Electric Automobile	540
Self-Supported Telephone, A	360
Semaphore Signal, Illuminated	1045
Semaphore, Toy	1092
Semi-Indirect Units	1326
Sending Colored Photographs Over the Wire	1254
Senses, Electric Stimulation of the	376
Sentenced by Telephone	1029
Sentry, An Electrical Steering	917
Servants by Wireless, Engaging	1123
Service Kitchen Cabinet	271
Service Switch Closes Burglar Alarm Circuit	731
Service, San Francisco's Electric	1269
Setting Railroad Clocks by Wireless	1096
Settle Cement Dust, Electricity to	1076
Sewing Machine Motor Control	265
Sewing Machine Motors in Strasburg, Introducing	1123
Sewing Machines, Motor and Brake Attachment for	1373

	Page
Shades and Lamps, To Display	97
Shading of Lights, Proper	1084
Shanghai, Electric Advertising in	1182
Shaving Lamp and Mirror	1008
Shaw, William E.	152
Shearing Sheep in England	1060
Sheep Shearing in England	1060
Shelves, Lighting Rows of	731
Sherlock of the Skies, A	536
Ship Automatic Tell-tale System	362
Ship Searchlight, Most Powerful Merchant	662
Ships, Automatic Compasses for	1186
Ships at Montreal, Unloading the	60
Ships of Navy to Report Positions	81
Shipwrecks, Head Lights for Victims of Night	258
Shock Absorber in a Rosette	197
Shock, Curious Case of Electric	923
Shocking Money	378
Shoe and Hosiery Display Device	165
Shoe Brush, A Trade Winning	734
Shoes, Miniature Elevator Displays	735
Shooting at Moving Pictures	444
Shooting by Searchlight	559
Shops and Shopping, Electrical	698
Shop Mathematics (Book Review)	748
Shop, Modern Electrically Driven	583
Short Circuit Tester, Ground and	976
Short Circuits Produced by Birds	1125
Shoveling Machine, Electric	554
Show Case Signs	729
Shriners, Electric Parade for the	262
Shrinkage, Electric Cooking Reduces	470
Shunt Motors Speed Up, Why	1240
Sick Friend Store, The	1296
Sidewalk Signs, German	257
Sign, A Home-made Electric	198
Sign, An Immense Projecting	23
Sign, Dignity of the Electric	759
Sign, Dressmaker's Illuminated	785
Sign, Effective	1065
Sign for a Restaurant	99
Sign Flasher, The Largest	804
Sign in New York, the Great Proctor Theater	415
Sign, Miniature Lamp Letter	440
Sign, Moving Panoramic	111
Sign, The Diamond Electric	1180
Sign That Stops Traffic in the Strand	23
Sign, Truck with Electric	60
Sign, Trinity's Electric	261
Sign, Unique Electric	448
Signs? Do you Believe in	448
Signs, German Sidewalk	257
Signs Needed in Mexico City	877
Signs in the United States and Canada, Electric	426
Signs, Show Case	729
Signal, A Combination Danger	407
Signal, An Old-Time Mine	433
Signal, Audible and Visible	1324
Signal, Automobile Horn for Factory	494
Signal, Electrical Railroad	506
Signal for Life Electric	226
Signal, Illuminated Semaphore	1045
Signal Lamp on Glove	244
Signal to Speakers, Lamps as Time-Limit	393
Signal Systems, Hospital	406
Signal, Water Pressure	291
Signaling Apparatus on Board a Warship, Searchlight	400
Signaling Between Dispatcher and Motorman	914
Signaling, Flashlight for	282
Signals Registered by Frog Muscles, Wireless	961
Signals, Eclipse of the Sun effects wireless	852
Signals Elevator, Stepping on Mat	787
Signals, Sound by the Ries System	758
Signals, Toned Telegraph	143
Sight, Illuminated Gem	980
Silent Servant, The	174
Silicon-Iron Alloy	421
Silver, Cleaning	1079
Simplicity of Quality, The	1311
Simplex Electric Heating Co.	1311
Simplon Tunnel Traffic, Increasing	298
Sir Hiram Maxim's Collision Preventer	612
Sir Joseph Beecham Comments on English Electrical Affairs	660
Skeleton, The Mysterious	1374
Skies, Besmirching The	907
Slack Hours in a Telephone Exchange, Rush and	312
Slicing Machine for Butchers, Meat	1003
Slide, The Magic Toboggan	182
Slides, Changing Song	21
Slot Machine for Photographing	42
Slug Holder, Telephone	1385
Smallest Electric Runabout	268
Smelter Plant in California, Electric	1304
Smelting Tin at Cornwall	256
Snowshoes, Cable Splicing on	1058
Snowstorm, New York Horse Car in	1351
Socket, A Temporary	563
Socket Attachment, Lamp	567
Socket, Locks Lamp in	90
Socket, Regulating	1008
Soil by Electric Power, Removing Top	1305
Soldiers, Using Wireless, British	843
Song Slides, Changing	21
Sonnenberg	575
Sorbonne, Wonderful Laboratories of the	1070
Soret Apparatus	125
Sound-Aid, Telephone, Increasing the	995
Sound Signals by the Ries System	758
Sound-Proof Telephone Booths, New	618
Southern Dinner, Table Decoration at a	71
South Africa, P. E. Wireless Club Member in	1097
South Texas, Wireless in the	520
Spark Coil, Baby	57
Spark Discharger, Photograph of a Rotary	480
Speaking Automaton, The	795
Speaking Telephone for the Home, Loud	643
Speakers, Lamps as Time-Limit Signal to	393
Specifications for a Good Engineer	328
Speed Indicator, Electric	1002
Speed Indicator, Illuminated	1153
Speed Maniac New Menace to Trucks	219
Speed of Pitchers Tested by Electricity	1090
Speeders, Warning to Motor	1130
"Spelling" Machine, An Electrical	427
Spiral, The Rotating	1197
Spot Light in a German Theater, Traveling	912
Spray Bottle Warmer	1136
Squirrels Gnaw Cables, Gray	251
Stable, Electric Fans in the	439
Stadium Station, The Harvard	916
Stage Effects, The Hippodrome and Its Electrical	900
Stage Lighting, Fortuny	341
Stagecraft, Some Secrets of Electrical	548
Stannos Wiring System, The	691
Star of Bethlehem, Electric	836
Starter, Automobile Electric	1132
Starter for Balky Horse, Electric	1086
Starter, Flywheel Motor	1382
Startling Trailer for Electric Car	1279
Stationery, The Electrician's	1109
Station, The Harvard Stadium	916
Station in Pasadena, Artistic Rest	444
Stations, Modern Interurban	1295
Stations on the Ground, Receiving	1231
Static, An Interesting Trick with	583
Static Electric Top	474
Static Electricity from the Air, Collecting	245
Static Electricity Fogs Films	636
Static Generator, Odd	1225
Static Machine, A Simple	76
Static Motor, A	182
Static Trick, Another Explanation of the	837
Steam, Electricity and Coal	1260
Steam Gauge, Illuminating the	295
Steam Heating System, Control for	1371
Steam in Seattle Mills, Electricity Cheaper Than	140
Steam Locomotives, Electricity Ousting the	1009
Steam Shovels Give Way to Electric	1017
Steam Versus Electric Transportation	18
Steel, Combustion Train Determines Carbon in	415
Steel Plant, Miniature Railway in a	1032
Steel Production in Norway, Electric	619
Steel Refining Furnace	779
Steel, Sawing Through	52
Steel Transmission Tower, Collapse of a	912
Steering Sentry, An Electrical	917
Steinmetz, Charles Proteus	127
Steno-phone, The	563

	Page
Step Light, Automobile	819
Steps Turn Off Cellar Light	1363
Stepping on Mat Signals Elevator	787
Stepless Car, New York's Double Deck	527
Stereopticon, A Compact, Portable	82P
Sterilization of Drinking Water by the Violet Ray	578
Sterilizer, French Water	656
Sterilizer, Instrument	1133
Sterilizing Barrels, Ozone for	996
Stethoscope to Detect "Valve Slap"	1257
Stimulation for Babies, Electric	310
Stimulation of the Senses, Electric	376
Stock, Cumulative Preferred	1120
Stocks and Bonds on Installment Plan	1250
Stone Tablets, The Carving of	259
Storage Battery Cars in Trains	923
Storage Battery in a Cake of Ice	926
Storage Battery Locomotive	51
Storage Battery, Lead Pipe	585
Storage Battery Tests	39
Storage Battery Voltmeter, A Pocket	94
Store Window, Electrical, Opportunities of the	817
Storing the Electric Fan	997
Storm, Strange Electric	1223
Stove, Automatic Electric Cook	174
Stove, Combination of Cereal Cooker and	72
Stove and Fireless Cooker, Quad	699
Stove, For the Toast	705
Stove, Hints for Using a Toast	582
Stove Plates, The Grinding of	822
Stove, Thermal Storage Electrical	367
Stove Welder, Electric	821
Straightener, A Fixture	293
Strain Insulator, Emergency	981
Strain Insulators	728
Strange Light from the Andes	1015
Strand, Sign That Stops Traffic in the	23
Stranded Wire Tips	3660
Strange Electric Storm	1223
Strap for Street Cars, Sanitary	883
Strasburg, Introducing Sewing Machine Motors in	1123
Streams, Measuring the Flow of Large	43
Street Car Efficiency in Germany	653
Street Car Held to Be "Vehicle"	1326
Street Car Lights, Regulator for	128
Street Car Ride, Longest Nickel	263
Street Car Safety Device	941
Street Car System, Metric Tie Up	920
Street Cars, Sanitary Strap for	883
Street Cars to the Leaning Tower	137
Street Indicator for Electric Cars	926
Street Light Fixtures, Mission	468
Street Lights Along the Curb	1173
Street Light, Portable	3911
Street Sweeper, Gasoline-Electric	58
Strikes, Central Station Power in Time of	203
Students Study American Telephone Methods, Chinese	442
Style in Trolley Construction	804
St. Elmo's Fire	745
St. Gotthard Electrification, The	874
St. Petersburg, Ozone Purifying System a Success in	873
Submarine, Details of the Whitehead	338
Submarines, Observation Tender for	248
Submarines, Wireless for	963
Subways for Constantinople	995
Subway, Naples Deep Running	203
Subway of Boston, The New Cambridge	180
Subway, Proposed London Postal	202
Subway Trains, Announcing	527
Subway, Unusual Feature of Paris	156
Suction Cup Fixture Holder	1209
Suez Canal	147
Sugar, Making by Electricity	869
Sugar Mills, Handling Cane in	167
Suggestions in Scale Lighting	485
Sultan of Lahej, Light for	647
Sultan of Sulu, From the Land of the	1126
Summer Home, Electricity in the	170
Sun as Lightbuoy Tender, The	1178
Sun Affects Wireless Transmission, Eclipse of	381
Sun, Bells Rung by	1292
Sunlight, Electric Current from	299
Superfluous Animals, Electrocution of	1069
Supporting Open Wiring in Concrete Buildings	730
Suppress Undesirable Telephone Noises, Device to	994
Surface Cars on an Elevated Line	453
Surgery, Adapting the X-ray to Minor	169
Surprising the Barbarians of Formosa	218
Suspended in Mid-Air	875
Swan Boat, The Electric	343
Sweden, Electric Heating in	645
Sweeper, Gasoline-Electric Street	58
Swedish Homes, Electric Heating in	205
Swinging Electric Breeze, The	370
Swinging Telephone Shelf and Door	199
Swiss Coffee Mill, A	265
Swiss Exploit Their Scenery, How the	1165
Swiss Villagers, Electricity for the Homes of	1346
Switch, A Floor Tread	199
Switch, Automobile Door Lighting	1269
Switch, For Small Motor Reversing	863
Switch, Battery	1258
Switch Cabinet, Tapping Individual Lights from the	732
Switch, Clock Operated Time	859
Switch Closes Burglar Alarm Circuit, Service	731
Switch, Electro-Magnet with Automatic	198
Switch, Fire and Burglar Alarm	266
Switch, Reversing	92
Switch, The Cut-Out	578
Switch, Wall Pull	569
Switches on Old Seventeen-Mile Grade, Safety	1319
Switchboard, Horizontal Telephone	1271
Switching, Electric Motors in Track	1169
Switzerland, As an American Boy Sees	708
Switzerland, Pumping Station on Areuse River in	929
Synthetic Rubber	530

T

	Page
Table Decoration at a Southern Dinner	71
Table, Electric Heater for the	659
Table Fan With Fern Dish	582
Table for the Residence Telephone	1351
Table Lamp, Veluria Glass	1081
Table, Paper Drill With Adjustable	695
Table Outlets, Dining	1241
Table Waiter, An Automatic	788
Tablet Commemorating First Telegraphic Train Order	555
Tachometer, Vibration	364
Tait, Frank Morrison	573
Take Your Own Pictures	866
Taking the Motor to the Work	1132
Talking Machine, Giant	772
Talking Machine Sales, Telephone as Aid to	529
"Talking Movies," Edison's Newest Inventing	1204
Talking Machine, The	1374
Tank Magnet, Plater's	461
Tanning Process, Electric	1379
Tantalum	1142
Tapping Individual Lights From the Switch Cabinet	732
Tar, Arc Carbons Made From	
Taste, The Electrics of	789
Taxicabs, Telephone Dispatching System for	139
Taxis in Berlin, Electric	101
Teacher, Electric Music	1350
Tea Room in the Blakstone Hotel	366
Technical Man, The Value of English to the	910
Technical School for Women, The Casino	144
Telafault, Exploring Cables With the	12
Telefunken Wireless Compass	1094
Telegrams in China, Native	1087
Telegraph Code, Learning the	280
Telegraph Crossarms After 43 Years	1071
Telegraph Line in the Wilderness, A	1263
Telegraph Line, Open Circuit	983
Telegraph Lines, Government	8
Telegraph Operator, How to Become a	154
Telegraph Poles, Woodpeckers Destroy	543
Telegraph Recorder, New	1253
Telegraph School, A Railroad	54
Telegraph Set, An Odd	281
Telegraph Signals, Toned	143
Telegraphic Train Order, Tablet Commemorating First	555
Telephone, A Self-Supported	360
Telephone as Aid to Talking Machine Sales	529
Telephone at Ball Games, Loud Speaking	935
Telephone Attachment	684

	Page
Telephone Book Holder	1303
Telephone Booth, Ventilated	927
Telephone Booths, New Sound-Proof	618
Telephone Cable in the English Channel, Laying	112
Telephone Cables, Drying	1241
Telephone Circuit, The First All Metallic	1014
Telephone, Charles Bourseul—French Inventor of the	1168
Telephone Credit Check System, A	1173
"Telephone," Deaf Mutes'	152
Telephone Desk Set, An English	61
Telephone, Dictating Letters by	668
Telephone Directories, New York	837
Telephone Dispatching on the Canadian Pacific	1322
Telephone Dispatching System for Taxicabs	139
Telephone, Diver's Outfit Equipped With	1201
Telephone Ear, Which Is Your	997
Telephone Enunciation, Commended for	959
Telephone Etiquette	173
Telephone Exchange, Brain a	565
Telephone Exchange, Deaf Children Visit	472
Telephone Exchange, Rush and Slack Hours in a	312
Telephone Extension Bell	1199
Telephone Feature at Masked Ball	53
Telephone Field, Complexity of	439
Telephone, First Money Earned From the	245
Telephone, First Foreign Language Over	247
Telephone for the Home, Loud Speaking	643
Telephone for Motor Cars	688
Telephone, Hints on Using the Long Distance	1048
Telephonia, Giraffo	956
Telephone, Incandescent Lamp as a	1307
Telephone, Increasing the Sound of a	995
Telephone in Timing Motor Boats	22
Telephone, Linking the Links of the Long Distance	670
Telephone, Marketing by	576
Telephone Methods, Chinese Students Study American	442
Telephone, Nickel	587
Telephone Noises, Devices to Suppress Undesirable	994
Telephone on Church Spire	61
Telephone Operators, First School for	919
Telephone Operators Compared, Promptness of American and English	264
Telephone Pole Setting	1002
Telephone,Receiver, Tray for	495
Telephone Repeater, A	993
Telephone, Saved by the Mine	38
Telephone Scratch Pad	572
Telephone, Sentenced by	1029
Telephone Service in Pekin	618
Telephone Service to Docked Vessels	898
Telephone Shelf and Door, Swinging	199
Telephone Slug Holder	1385
Telephone, Some Odd Facts About the	141
Telephone Station in the World, Highest	994
Telephone Stations of the U. S. Forest Service	800
Telephone Switchboard, Horizontal	1237
Telephone System, Simple	1370
Telephone Systems, A General Alarm for	1024
Telephone, Testing for the Residence	1351
Telephone, Testing Wine With a	299
Telephone, To Make a Simple One-Way	730
Telephone Transmitter, Individual	149
Telephone Troubles and How to Find Them (Book Review)	505
Telephone Vault, Providing Pure Air in	463
Telephone, Ventriloquism and the Loud Speaking	1323
Telephone Wiring	1234
Telephones for Theaters, Seat	333
Telephones in England, Roadside	535
Telephones in Jerusalem	685
Telephones in Pekin, 6,500	993
Telephones in Tripoli	249
Telephones in the Vatican	1212
Telephones Per Capita in Scandinavian Countries	747
Telephone's Range of Usefulness, Increasing a	199
Telephones Served With Your Meals	1336
Telephones, The World's	495
Telephoning Through the Tow Line	1042
Telling the Time at Night	957
Telltale Lamp for Heaters and Irons	460
Telltale System, Ship Automatic	362
Temperature From a Distance, Measuring	1199
Temperature of the Arc	789
Temperature Regulator, Automatic	164
Temperatures, Electrical Resistances at Very Low	921
Temperatures, High Furnace	491
Temperatures With an Electric Thermometer, Measuring	25
Temporary Socket, A	363
Temporary Wiring, Safe	96
Tender for Submarines, Observation	248
Tending Baby by Telephone	805
Tension at Night, Playing	520
Tension on the Surface of Charged Conductors	1324
Teredo, Destructive	142
Terminal, New York's Grand Central	1137
Termites Destroy a Cable	1303
Tesla's Plan of Electrically Treating School Children	813
Test Bell, A	857
Test for Radium, A	335
Tester, A Convenient Battery	865
Tester, Daylight Egg	570
Tester, Ground and Short Circuit	976
Tester, The Bond	1258
Testing a Typewriter in a Window	735
Testing for Lamps "on"	601
Testing Gun Carriages at the Krupp Works	657
Testing Lamps, Time Savers in	95
Testing of Water Supply, Electric	865
Testing the Permanence of Colors	866
Testing Wine With a Telephone	299
Testing Wireless in the Desert	186
Thanksgiving Week, The First	702
Thawing Frozen Water Pipes	1137
Thawout on Record, The Biggest	36
Theater Earphones	533
Theater in Trolley Car, Moving Picture	351
Theater Sign in New York, The Great Proctor	415
Theater Spotlight in a Church	912
Theater, The Usherless	1268
Theaters, Seat Telephones for	333
Theaters, Whisper Girl for	323
Theft of Lamps, Preventing	58
"The Gasoline Automobile" (Book Review)	875
"The Modern Gasoline Automobile" (Book Review)	996
The Modern Locomotive (Book Review)	300
Thermal Storage Electrical Stove	367
Thermometer, How to Make a Resistance	388
Thermometer, Illuminating the	697
Thermometer, Measuring Temperatures With an Electric	35
Thermometer, Thermostatic	164
Thermometers, Electric	673
Thermostat	164, 172
Thermostatic Thermometer	164
Thirtieth Anniversary of Electric Lighting in New York	680
Thomas A. Edison Honored	876
Thorne Elliot's Burglar Alarm	178
Thoughts for Housewives	1221
Three-Wheeled Electric Delivery Wagon	265
Threshing Machines, Lightning Rods to Protect	926
Thunder Is So Loud, Why	841
Tickling the Public's Ribs	347
Tie Wire, Getting Rid of the	388
Time at Night, Telling the	957
Time-Limit Signal to Speakers, Lamps as	393
Time Recording Lock	1274
Time Regulation, Radio-Telegraphy in	49
Time Savers in Testing Lamps	95
Time Signals	1233
Time Signals of Greenwich, The	993
Time Switch, Clock Operated	859
Timing Motor Boats, Telephone in	22
Tin at Cornwall, Smelting	25
Tire Economy	818
Tire Pump, Automobile	1259
Tire, The Rolling Auto	496
Titanic Disaster, Wireless in Connection With the	212
Titanic, Memorial to Phillips of the	995
Toast Stove, For the	705

	Page
Toast Stove Hints	829
Toast Stove, Hints for Using a	582
Toaster, An Electric	490
Toaster, Electric	1136
Tobacco Jar Humidor	1243
Toboggan Slide, The Magic	182
Toll Telephone Practice (Book Review)	748
To Make an Electrophorus	958
To Make Bell Strike the Hours	975
Toned Telegraph Signals	143
Tool Chest Lock and Alarm	976
Tool for Forming Wire Joints	728
Tools for Housekeeping	176
Tools Hardened by Electricity	1309
Top, A Color Blending	798
Top Soil by Electric Power, Removing	1305
Top, Static Electric	474
Torch, Double Jet Gasoline	860
Torch for Electricians, Emergency	293
Torch for Linemen, New	1362
Torch, Kerosene	1005
Torpedo, The Radio-Automatic	1093
Tower, An Archimedes	1324
Tower, Collapse of a Steel Transmission	912
Tower Lights of Girard College	247
Towers, The Great Arlington	1065
Tow Line, Telephone Through the	1042
Toy Semaphore, Electrically Operated	1092
Toys, City of	838
Track Ahead, Lighting the	637
Track Switchink, Electric Motors in	1169
Trackless Trolley in Dundee	1066
Trade Winning Shoe Brush, A	734
Trade With India, Possibilities of	1127
Traffic in the Strand, Sign That Stops	23
Tragedy of Wash Day, The	277
Trailer for Electric Car, Startling	1279
Train, A Paint	908
Train, Electric Circus-Museum	924
Train Order, Tablet Commemorating First Telegraphic	555
Train Struck by Lightning	335
Trains, Storage Battery Cars in	923
Trains, Wireless to Stop	480
Training Station, The Great Lakes Naval	522
Training Youth for the Electrical Age	834
Tramcars, Electric Clocks in	241
Trams of a Utah Mine, Aerial	254
Transformer, Bell Ringing	820
Transformer Construction	192
Transformer, Two Hundred Watt Closed Core	1356
Transformer, Variable Low Voltage	977
Transformation, The Conductor's	921
Transmission Lines, How Farmers Tap the German	1
Tarnsmission Tower, Collapse of a Steel	912
Transmission Voltage, 150,000	
Transmitter From Packing, To Prevent a	485
Transmitter, Individual Telephone	149
Transmitting Phonograph Music	862
Transportation, Steam Versus Electric	18
Transporting an Engine by Cable	1087
Transporting Lamps, For	1302
Traveling Spot Light in a German Theater	912
Tray for Telephone Receiver	495
Tread Switch, A Floor	199
Treadle Controls the Motor	265
Treatment of Children, Electrical	45
Tree Insulator	570
Tree of Light, The	1177
Tree System, The	1371
Tree Vibration for Saving Buds From Frost	528
Trick With Static, An Interesting	583
Trimming Off the Rough Spots	167
Trinity's Electric Sign	261
Tripoli, Telephones in	249
Triscuits Baked by Electricity	705
Trolley, A Castle on a	899
Trolley Car, Boston's Articulated	1292
Trolley Car, Moving Picture Theater in	351
Trolley Cars, An Elevated Railway for	1309
Trolley Construction, Style in	804
Trolley Cradle for the Baby	68
Trolley in the Remote Places of the Earth, Building the	1144
Trolley Line, A Landmark That Turned a	562
Trolley Wire, Mine Mules and the	409
Trolley Wire Fastener, A	982
Trioley Wire Frees Captive Balloon	1260
Trolley Wires for Airship	245
Trophy Fixture	736
"Trouble Hunter," The	312
Troubleman's Portable Searchlight	1183
Trouble Shooters, The Motorcycle and	773
Truck as a Moving Power Plant, Electric	1322
Truck for Handling Armatures	491
Truck in Twine Factory, Electric	823
Truck Makes Record Run, Electric	143
Truck With Electric Sign	60
Trucks, Demonstrating Gasoline Auto	736
Trucks, Speed Maniac New Menace to	219
Tube Lamp, Novel	426
Tube Lamps, New Way of Making Quartz	746
Tugboat, An Electric	692
Tumbler Boxes, The	1112
Tuner, Interference and the Inductive	78
Tungsten, A New Use for	135
Tungsten Electric Furnace	1069
Tungsten Filament Plays Tricks	1308
Tungsten Lamps Are Better Than Carbon Ones, Why	1207
Tuning Fork, Safe Opened With a	1198
Tunnel Light, Automatic	1279
Tunnel Traffic, Increasing Simplon	298
Tunnel Under the English Channel	993
Tunnels of Central London Railway, Ozone in	1300
Turbine, The Largest Water	1337
Turbine Wheel, Electric Boiler and	278
Turbine Windmill, The Eustis	1033
Turks Began to Fight, And Then the	1071
Turn Down Lamp, Long Cord	268
Turning Down Electric Lights	769
Turning Point in Pupin's Life	869
Turns the Fan Off	390
Turntable for Window, Revolving	297
Twentieth Century House, Edison's	948
Twine Factory, Electric Truck in	823
Two Hundred Watt Closed Core Transformer	1356
Two Shows in One	137
Typewriter, Automatic	1000
Typewriter in a Window, Testing a	735
Tyrol, Cable Incline in the	812

U

	Page
Ultra-Violet Rays, Deciphering Manuscripts with	243
Uncle Sam Investigates Electrical Disturbances	1046
Uncle Sam Trains His Sailors for Wireless, How	478
Uncle Sam's Emergency Lines of Communication	8
Uncle Sam's Navy, A World Wireless System for	712
Underground Transportation for Parcel Post	1170
Underground Work, Modern	1041
Unloading the Ships at Montreal	60
Unique Ammeter	837
Unique Electric Sign	448
Unique Lamp Exhibit	1251
Unit Orchestra, The	50
Unit Time in Germany, Wireless	962
United States Asbestos Production Doubled	152
United States First in Communication Facilities	621
United States Forest Service, Telephone Stations of	800
Universal Hour, The	1233
Universal Insulator	199
University, An Industrial	859
University Holds Open House, When a	930
University of Chicago, Harper Memorial Library	757
Use and Misuse of Light	1025
Use of Electric Current, Novel	960
Usherless Theater, The	1368
Using Old Carbon Ends	87
Utah Mine, Areial Trams of a	254
Utility Heater	165
Utility of the Modern Searchlight, General	1006
Utilizing an Out-of-the-Way Corner for Effective Display Space	740
Utilizing the Power of the Columbia	1310
Uviol Quartz Lamp	313

V

Page

Vacuum Act 1043
Vacuum Cleaner Bag, Don't Neglect the 372
Vacuum Cleaner, Modern House with... 270
Vacuum Cleaners, Duster for..... 795
Vail Gift to Boston "Tech" Library..... 509
Valentine Tale, A 1078
Value of English to the Technical Man, The 910
"Valve Slap," Stethoscope to Detect.... 1257
Vampires of the Deep, Destroying the.. 516
Vane, An Electric Weather..... 476
Vapor Lamp, A New Electric..... 1260
Vaporized Quartz 1317
Variable Low Voltage Transformer.... 977
Variable Resistance Unit, Instructor's.. 1320
Vase and Electrolier, Cut Glass..... 933
Vatican, Telephones in the..... 1212
Vault, Laundry in a Bank..... 67
Vault, Providing Pure Air in Telephone. 463
"Vehicle," Street Car Held to Be..... 1326
Vehicles and Horse Feed, Electric..... 12
Vehicles for Business and Pleasure, Electric 24
Velocity, Electro-Magnetic 1125
Velocity, Measuring Wind 943
Veluria Glass Table Lamp..... 1081
Ventilated Telephone Booth 927
Ventilator, An Office 1005
Ventriloquism and the Loud Speaking Telephone 1323
Versatile Small Motor, A..... 1220
Vessels, Telephone Service to Docked.. 898
Vest Buttons, Illuminated 572
Vest Pocket Transmitter 149
Vibrating Rectifier 1135
Vibrating the Whole Body..... 927
Vibration for Saving Buds from Frost, Tree 528
Vibration Tachometer 364
Victor H. Tousley 696
Victor Postcard Projector 183
Violet Ray, Sterillization of Drinking Water by the 578
Visiting Lady, A Demonstration by the. 70
Vladimir Karapetoff 1334
Volcano Eruption, Lightning Display at 352
Volcanoes, Electricity in 1055
Voltage 150,000, Transmission 816
Voltmeter, A Pocket Storage Battery... 94

W

Waffle Wagon, An Electric..... 337
Wagon, An Electric Waffle..... 337
Wagon Display, Attractive 502
Wagon, Keeping Tab on an Electric.... 1254
Wagon Wheel Chandelier, A..... 67
Waiter, An Automatic Table..... 788
Waldo Arnold Layman 462
Walking on a Magnetized Floor..... 155
"Walking" Saw, A 60
Walnuts by Electricity, Ripening..... 111
Wall Pull Switch 569
Walls, Luminous Marble 772
Waltons, Attracting the Isaac..... 296
Ware, Economy of Electric..... 1152
Ware Is Constructed, How Electric.... 996
Warm Meals for the Horse..... 1186
Warmer, Bed 1362
Warmer, Spray Bottle 1136
Warmers for Baby Cribs, Electrical.... 441
Warming Pad, Puppies Appreciate..... 929
Warning to Motor Speeders..... 1130
Warns the Man Behind..... 789
Warship, Searchlight Signalling Apparatus on Board a..... 400
Warships Injured by Electricity..... 1331
Wash Day, The Tragedy of..... 277
Washboard Principle, Washing Machine with 177
Washing Cars by Electric Power..... 1169
Washing Machine, Money 250
Washing Machine, The "Easy"..... 819
Washing Machine with Washboard Principle 177
Washington, Fountain of the "Peace Palace" at 906
Washington Greets Honolulu 1232
Washington Monuments Lightning Rods 427
Waste, Electricity from Household..... 298
Watch, Apparatus for Demagnetizing a 293
Watch Demagnetizers 197
Watch Face Lighter and Magnifier..... 856
Watch the Wheels Go Round..... 498
Watches, Effect of Magnetism on..... 1279
Water by the Violet Ray, Sterilization of Drinking 578
Water Festival, Cadillaque — Detroit's Beautiful 544
Water Carnival, Automatic Annunciator at a 546
Water, Electrolysis of 977
Water Flow, Measurement of..... 1111
Water from Beyond the Mohave, Los Angeles 513
Water Heater, An Electric..... 294
Water Heater, Electric 1134
Water Heater, New Type Instantaneous 166
Water in a Hurry, Boiling..... 165
Water Power of Iceland..... 458
Water Pipes, Thawing 36
Water Pressure Signal 291
Water Rheostat, Adjustable 291
Water Sprays to Encourage Crops, Electrified 1056
Water Sterilizer, French 656
Water Supply, Electric Testing of..... 865
Water Tank, Electric Heaters in a..... 363
Water-Tight Receptacle and Ring..... 860
Water, The Electricity of Drops of..... 1171
Water to New York from the Catskills, Bringing 416
Water Wheels, From Ancient to Modern 344
Watts, What Horsepower Really Measures in 621
Wave Propogation, Effect of Ionization on 846
Wave Now Possible, 60,000 Meter..... 842
Wave Motors 1124
Wave Sets, Experimental 200 Meter 1352, 1228
Waves, Neon and Electric..... 749
Waves, Power from the Ocean..... 203
Wax Melter, Sealing 57
Way Station, Crane Service at a..... 1302
Weather and the Output Curve, The.... 1284
Weather Bureau, Proposed Atlantic.... 715
Weather Bulletins for French Air Pilots 1095
Weather Vane, An Electric..... 476
Weed Burners on Electric Railways.... 905
Weighing Machine, Automatic 361
Welder, Electric Stove 821
Welding Process, New Electric..... 333
Welsh Orme, Electricity Conquers the.. 433
Western Bumper Crops, Electricity Moves 1275
Western Electric Co. 760
Westinghouse Electric & Mfg. Co..... 886
What the Motorist Shall Wear..... 276
What Horsepower Really Measures in Watts 621
"What If in the Tomb I Awake?"..... 40
What Is Electricity? 663
Wheel Chandlier, A Wagon..... 67
Wheel of Flags 496
Wheelsman, An Automatic 135
Where a Quart of Water Equals a Horse Power of Electricity 881
Where Carbon Boils 1294
Which is Your Telephone Ear?..... 997
Whisper Girl for Theaters..... 333
White and Black Coal..... 1159
"White Hope" Fan Display, A..... 392
White Light from the Mercury Lamp... 1122
White Lines to Protect Life..... 1318
White Way and the Chickens, The..... 944
Whitehead Submarine, Details of a..... 328
Why Thunder Is So Loud..... 841
Why Tungsten Lamps Are Better Than Carbon Ones 1207
Woman and the Electric Motor..... 469
Woman's Artistic Work, A..... 464
Woman Who Drive the Electric Car.... 700
Women, The Casino Technical School for 144
Wonder-Work of the Mohawk Valley, The 1018
Wonders, Electro-Chemical 764
Wonderful Laboratories of the Sorbonne 1070
Wood, Electric Seasoning of..... 1077
Wood Sawing Machine, Electric..... 688
Woodpeckers Destroy Telegraph Poles. 543
Woolworth Building—King of Skyscrapers 311
World Wireless System for Uncle Sam's Navy 712
World's Greatest Battleship and Her Electrical Equipment, The..... 1293

	Page
World's Telephones, The	495
Work Bench Fixtures, Adjustable	734
Works of Art, Illumination of	275
Wig Advertising	498
Wilderness, A Telegraph Line in the	1263
Willis Island, The Electrical Wizard of	314
Wind Velocity, Measuring	943
Winder Elwell Goldsborough, M. E.	242
Windmill, The Eustis Turbine	1033
Window and Door Alarm Contacts	983
Window Attraction, Moving Headlight as	735
Window, Candy Kettle in	97
Window Display, Aeroplane Propeller Operates	98
Window Display, Harmonizing Cord with	100
Window Displays, Emphasizing	497
Window, Electrical Store	817
Window Light Fixture, Odd	99
Window of Blooms by Lamp Light, A	66
Window, Revolving Turntable for	297
Window, "Save a Dollar"	985
Window Sign and Reflector, Combined	1322
Window, Testing a Typewriter in a	735
Windows Artificially Lighted	988
Windows, Invisible Multiple Rotary for	736
Wine with a Telltone, Testing	299
"Winking Willies," The	1244
Wire Fastener, A Trolley	982
Wire, Getting Rid of the Tie	388
Wire in Quartz Tubes, Placing Platinum	393
Wire Joints, Tools for Forming	728
Wire, Record-Breaking Reel of	897
Wire Tips, Stranded	360
Wires, Deadening the Hum of Line	299
Wires for Airship, Trolley	245
Wires, Neat Fastening for Entrance	199
Wires, The Pathfinders of the	428
Wireless Season, The	842
Wireless Set, An Efficient	845
Wireless Signals, Eclipse of the Sun Affects	852
Wireless Signals Registered by Frog Muscles	961
Wireless Station at Arlington, Navy	190
Wireless Station at Central Point, Ore., Federal	588
Wireless Station, Carnegie Schools	595
Wireless Stations for Canada, Nine New	1232
Wireless System for Uncle Sam's Navy, A World	712
Wireless System, Great Brazilian	718
Wire and Its Manipulation, Fishing	290
Wireless Antenna for Balloons	718
Wireless at Catalina Island	185
Wireless Bill, Alexander	592
Wireless, Birds and the	957
Wireless Call-Letters, New	483
Wireless, Canadian Boats Compelled to Carry	1357
Wireless Club Member in South Africa, P. E.	1097
Wireless Compass, Telefunken	1094
Wireless Congress	507
Wireless, Determining Longitude by	620
Wireless, English Boy Scouts Studying	382
Wireless Experiments in France, Aeroplane	1096
Wireless for Submarines	963
Wireless from Airships	203
Wireless from Korea, San Francisco Hears	189
Wireless Hook-up	190
Wireless, Holland Fishing Boats Equipped with	393
Wireless, How Uncle Sam Trains His Sailors for	478
Wireless Hints	185
Wireless in the Antarctic	874
Wireless in the Balkan War	1124
Wireless in Chicago Schools	384
Wireless in the Desert, Testing	186
Wireless in the South Seas	620
Wireless Instructions, Foot Amputated by	301
Wireless Law, How to Comply with the New	847, 719
Wireless Law, Formalities to Be Observed in Connection with the New	964
Wireless, Low Aerials for	1252
Wireless, Map Making by the Aid of	748
Wireless Motor Car, A German	716
Wireless News for Desolate Islanders	81
Wireless on Ferry Boats	506
Wireless on Fishing Boats	190
Wireless on German Airships	591
Wireless on Monoplane	526
Wireless Operations, Germany's Long Distance	262
Wireless Operators, Advice to Prospective	379
Wireless Outfit as Moving Picture Attraction	1355
Wireless Outfit, Knapsack	718
Wireless Outfits for Small Boats	283
Wireless Picture Sending	693
Wireless Record from Persia, Long Distance	747
"Wireless Telegraphy and Telephony Simply Explained" (Book Review)	1254
"Wireless Telegraphy and Wireless Telephony" (Book Review)	875
Wireless Telegraphy and Telephony (Book Review)	505
Wireless Telegraphy on Aeroplanes	393
"Wireless Telegraphy Simply Explained" (Book Review)	1381
Wireless, The	232
Wireless, The Dignity of the	204
Wireless, The Romance of	233
Wireless to Stop Trains	480
Wireless Told, What the	212
Wireless Towers, The Arlington	1065
Wireless Transmission, Eclipse of the Sun Affects	381
Wireless Unit Time in Germany	962
Wireless Waves, Desert Earth Conducts	874
Wireman, For the Amateur	201
Wireman's and Engineer's Fuse Kit	390
Wiring a Simple Problem, House	69
Wiring Alone, Leave the	875
Wiring, Conveniences in House	733
Wiring Damp Places	726
Wiring, English and American Practice Compared, Electric	486, 597
Windmill Farm Lighting Plant	655
Wiring, High Tension Roof	1206
Wiring Houses for Electric Light (Book Review)	300
Wiring in Concrete Buildings, Supporting Open	730
Wiring, Knob and Tube and Cleat	1359
Wiring, Safe Temporary	96
Wiring System for Electric Irons	294
Wiring System, The Stannos	691
Wiring, Telephone	1234
Wizard Lead Pencil, The	959
Wizard of Willis Island, The Electrical	314

X

X-ray Apparatus, Novel	652
X-ray, Curious Uses of the	1355
X-ray in Observing Bone Structure	559
X-ray in Studying Athletes	343
X-ray Light, The Firefly's	205
X-ray to Minor Surgery, Adapting the	169
X-ray Tubes, Absorption in	351
X-rays and Coal	1273
X-rays, Examining Coal with	618
X-rays in Testing Precious Stones	264
X-rays, Inspecting Eggs with	394

Y

Yellowstone Park, Radium in	1148
Youth, For the Electrical Age, Training	834

Popular Electricity
In Plain English
Henry Walter Young, Editor

Vol V | May, 1912 | No. 1

CONTENTS

HOW FARMERS TAP THE GERMAN TRANSMISSION LINES 1
HYDRO-ELECTRIC WONDERS IN CALIFORNIA. 2
UNCLE SAM'S EMERGENCY LINES OF COMMUNICATION. By Waldon Fawcett 8
Safe Expert Uses an Electro-Magnet 11
Exploring Cables with the Telafault 12
Electric Vehicles and Horse Feed 12
SOME SECRETS OF ELECTRICAL STAGECRAFT. By T. J. Newlin 13
Flashlight Directs Night Rescue 18
Steam versus Electric Transportation 18
The Autocall 18
THE PULMOTOR 20
Puzzle: Find the Motor 21
Changing Song Slides Around 21
Telephone in Timing Motor Boats 22
Chicago-New York Business Trip Without Going Out of Doors 22
Bird Aeroplances 23
An Immense Projecting Sign 23
Sign That Stops Traffic on the Strand 23
ELECTRIC VEHICLES FOR BUSINESS AND PLEASURE. By W. C. Jenkins 24
ELECTRICAL SECURITIES. By "Contango" 30
Pumping Barges on the Missouri 33
Measuring Temperatures with an Electric Thermometer 35
THE BIGGEST THAWOUT ON RECORD. By Arthur H Miller 36
Saved by the Mine Telephone 38
Kicking that Battery Around 39
"What if in the Tomb I Awake?" 40
Record Run of the "Lightning Bugs" 41
Euphonious Chemistry 41
Dime in the Slot and a Photo in One Minute 42
Hotel that is Electrically Charged 42
MEASURING THE FLOW OF LARGE STREAMS. 43
A Remarkable Case of Electrolysis 44
Linguist Operators 45
Grinding Down the Rails 45
The Gruenwald Grotto 46
"Freezing Out" the Resistance 46
METROPOLITAN MINING BY ELECTRICITY. By George H. Hall 47
Illuminating a Carnival 47
THE UNIT ORCHESTRA. By Maurice Rosenfeld. 49
Locomotive that Hauls its Own Power 51
Sawing Through Steel 52
Telephone Features at a Masked Ball 53
A German Precaution 53
Religion Advertising 53
Looping-the-Loop 54
A Railroad Telegraph School 54
Pitchblende Mining 54
Reciprocating Electric Drill 55
Four Methods of Picture Projection 55
Coin Operated Piano 56
Current Converter for Private Garages 56
Sealing Wax Melter 57
Baby Spark Coil 57
Laundry in a Bank Vault 57
Heating Combs Electrically 58
Gasoline-Electric Street Sweeper 58
Locking Up Lamps to Prevent Theft 58
Extension Lamp Arm 59
Moisture Regulator for Rooms 59
Dust Collector on Polishing Machines 59
A "Walking" Saw 60
Unloading the Ships at Montreal 60
Truck with Electric Sign 60
Handy Lamp Bracket 61
An English Telephone Desk Set 61
Telephone on Church Spire 61
ELECTRICAL MEN OF THE TIMES. Horatio A. Foster 62
THE LURE OF BEAUTY 64
A Window of Blooms by Lamp Light 66
A Wagon Wheel Chandelier 67
Trolley Cradle for the Baby 68
Bridget's Change of Heart 68
House Wiring a Simple Problem 69
Radium Baths in Bohemia 69
Artistic Electric Candlesticks 70
An Advantage of Electric Cooking 70
A Demonstration by the Visiting Lady 70
Table Decoration at a Southern Dinner 71
Business Methods Good for the Home 71
Combination of Cereal Cooker and Stove 72
Fundamental Principle of Electric Cooking 72
The Kitchen to Become a Laboratory 72
Mental Character Determined by Machine 72
A College Prank 73
Electrifying the Checker Game 73
Fooling the Chicken Thief 74
Illuminated Checkerboard Table 75
The Ambrose Channel Lightship 75
Caller is Which Door? 75
PARIS ENGINEER'S ODD DINING ROOM RAILWAY 76
A Simple Static Machine 76
INTERFERENCE AND THE INDUCTIVE TUNER. By Marlin A. Andrews 78
A Hot Wire Meter 81
Ships of Navy to Report Positions 81
Wireless Aids for Desolate Islanders 81
Restoring Old Hard Rubber to Its Natural Color 82
Questions and Answers in Wireless. By A. B. Cole. 82
Directory of Wireless Clubs 85
HOUSEHOLDERS, KNOW YOUR METER. By Guy R. Grove 86
Using Old Carbon Ends 87
How an Electrical Clock Operates 87
A "Good Thing" in Conduit 89
Light Adjuster for the Drafting Table 89
Locks Lamp in Socket 90
Leakage Alarm for Boats 91
An Imitation Coal Fire 91
Reversing Switch 92
How to Make an Electric Gas Lighter 92
Convenient Fixture Control 93
A Pocket Storage Battery Voltmeter 94
A Simple Door Bell Alarm 95
Time Savers in Testing Lamps 95
When the Oil Cup is Empty 95
Safe Temporary Wiring 96
Light for the Blacksmith 96
Firing Flashlights Electrically 96
To Display Shades and Lamps 97
Candy Kettle in Window 97
Aeroplane Propeller Operates Window Display 98
Sign for a Restaurant 99
An Odd Window Light Fixture 99
The Rotating Barber Pole 100
Harmonizing Cord with Window Display 100
New Books 100
A New Series by Archie Rice 101
Electric Taxis in Berlin 102
SHORT CIRCUITS 102
COMMON ELECTRICAL TERMS DEFINED 104

RENEWALS When your subscription expires, you will find a renewal blank enclosed here. You should fill out and return with remittance at once to avoid missing a number. Positively no copies will be mailed on any subscription after same expires unless renewed, and we cannot agree to begin subscriptions with back numbers. The date on wrapper of your magazine shows issue with which your subscription ends. The extension on this date to period covered by renewal is sufficient receipt. If any other is desired it should be requested at time of renewal.

CHANGE OF ADDRESS Notify us promptly of any change in your address, giving both the old and new location. Since our mailing list for each issue closes the 5th of the preceding month (i. e., list for February closes January 5th), changes received after the 5th must necessarily take effect with issue for second month following. Postmaster as well as Publisher should always be notified of changes in order to forward mail sent to old address.

ISSUED MONTHLY BY POPULAR ELECTRICITY PUBLISHING CO., Commercial Bldg., Chicago, Ill.
YEARLY SUBSCRIPTION, $1.50; CANADIAN, $1.85; FOREIGN, $2.25; SINGLE COPY, 15 CENTS

No additional copies will be sent after expiration of subscription except upon renewal.
Entered as Second Class Matter April 14, 1908, at the Post Office at Chicago, under Act of March 3, 1879

Copyright 1912, by Popular Electricity Publishing Co.

A Government Telegraph Office in Alaska

(Uncle Sam's Emergency Lines of Communication, page 8)

LIBRARY
SEP 21 1922

Popular Electricity
In Plain English

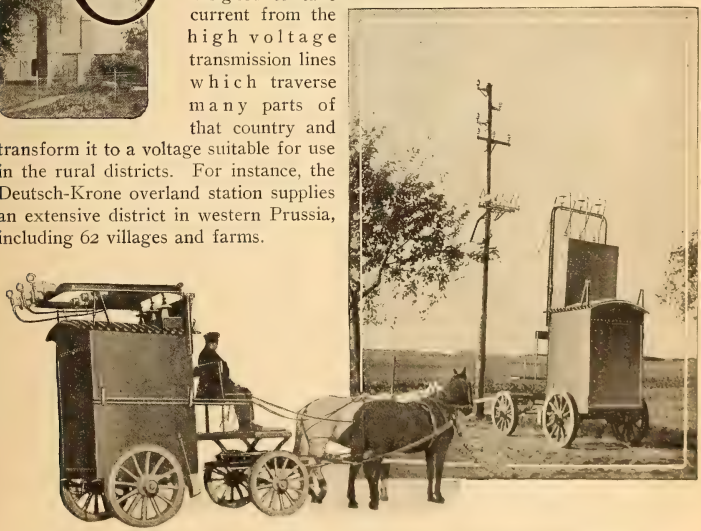
VOL. V MAY 1912 No. 1

How Farmers Tap the German Transmission Lines

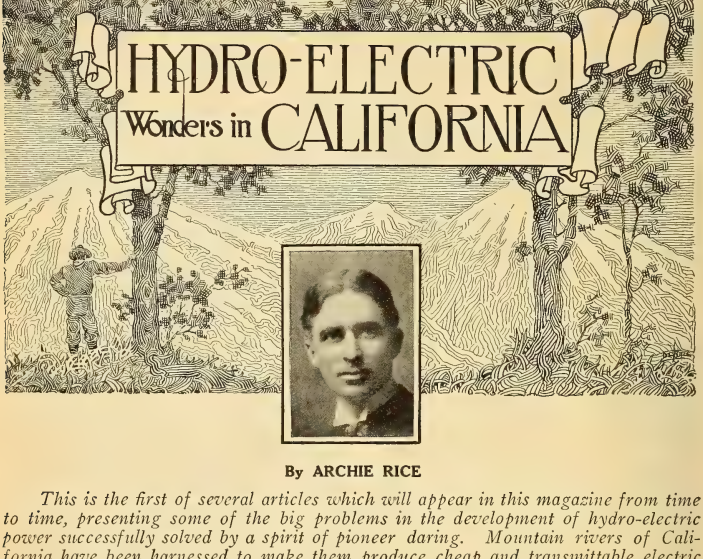
VERLAND transmission stations" is a term used in Germany to denote a type of installation designed to take current from the high voltage transmission lines which traverse many parts of that country and transform it to a voltage suitable for use in the rural districts. For instance, the Deutsch-Krone overland station supplies an extensive district in western Prussia, including 62 villages and farms.

Stationary and portable transformer stations are used to transform the high tension current to a voltage suitable for the use of the patrons. The stationary stations are picturesque little houses of brick, as shown by the initial cut, and are generally to be found in the villages.

Farmers are more and more coming to use the current for threshing, plowing, grinding, etc., and for their benefit a type of portable transformer house has been designed. This is drawn on wheels by a pair of horses to the point on the main line most convenient to a farm or group of farms to be supplied.



USE OF A PORTABLE TRANSFORMER IN GERMANY FOR SUPPLYING FARM DISTRICTS



By ARCHIE RICE

This is the first of several articles which will appear in this magazine from time to time, presenting some of the big problems in the development of hydro-electric power successfully solved by a spirit of pioneer daring. Mountain rivers of California have been harnessed to make them produce cheap and transmittable electric energy. Electricity so produced has been applied to California's mines and fields and factories and to furnish light and transportation in her cities. And the writer of the articles is intimately familiar with the whole situation.—Editorial Note.

MAKING A RIVER DISGORGE ITS BURIED GOLD

Gold is where you find it. Electric power is wherever you can develop it.

California was always amazingly rich in both of these possibilities. But the gold deposits were never discovered till 64 years ago. Then during one season a hundred thousand red shirted miners, swarming along the foothill streams, shoveled and washed gravel by hand and harvested $83,000,000 in gold. They employed the most primitive of individual methods.

Twenty years later organization had developed companies and bigger schemes to get at the gold wholesale.

The mountain streams are steep in California. Ditches were surveyed to tap the flow high up in the hills, lead the water gradually out along some projecting ridge, and from an attained elevation suddenly shoot it down through a pipe line.

In that way torrents of water directed through mammoth nozzles rocketed and roared and tore asunder hillsides and dissolved and sluiced off everything but the bowlders, the smaller stones, and the actual gold. The weight of the gold lodged it safely along the little wooden cleats across the bottom of the outlet flumes.

Before another 20 years this gigantic process of converting foothills into muddy water was found to be alarmingly filling up the river channels down in the great level agricultural valley.

The farmers had gone along for a quarter of a century with more land than they could properly cultivate. They had had levees built here and there to confine the Sacramento River to a restricted channel. As the bed of the river filled up, the levees were built a little higher. At Marysville the surface of the water behind the restraining levee gets higher than the housetops.

Miners' mud seriously lessened the navigability of the Sacramento River. It increased for miles the spring menace of overflowed fields. And when the water got onto the fields it had to remain till it evaporated.

Such were the conditions that brought about the long legal and legislative war between California's valley farmers and her mountain miners. Nearly everybody was a miner at first. Farming didn't count. But when mining had become an organized industry operated by companies with large capital, farmers had grown increasingly numerous and important. Moreover, they had votes.

Sacramento, the capital of California, is on the river, right at the heart of that great valley. What the hydraulic mining back in the foothill country was doing to that big river and its cheap transportation for farm products was a close object lesson for the legislators. They have always convened during the flood season.

So hydraulic mining was practically prevented in California by law.

There came a time when the electrical engineer began to see opportunities in California. He never even dreamed of the actual magnitude of what was to develop. Nor did any one else.

Plenty of gold was left where the hydraulic miners used to get it out of the hillsides. The old pick-and-shovel boys had only worked the banks of the larger streams down to where seepage water flooded them out. But as far as they went they got gold.

Gold mining is like any other commercial industry. It pays only when it yields more money than the expense of producing the product.

They might have built portable cofferdams along the rivers and pumped out the water while getting at the gold bearing gravel. But the cost would have been too great. They might have constructed floatable steam dredgers and scooped up gravel from the depths of the streams. But fuel and its transportation were expensive. Coal has always been scarce in California. The State's amazing oil fuel industry was scarcely in its infancy, and when developed later was nearly 300 miles from the placer gold fields.

Twenty years ago the world didn't know that electric energy could be created in one place and transmitted great distances for use in another place. It was supposed that where electricity was generated right there it must be used. Telegraph and telephone wires might carry enough current to operate the sensitive little instruments at the stations and the terminals. But to send hundreds of horsepower by wire was a different and a dangerous thing.

Somebody had to make the experiment. It happened that physical conditions, commercial prospects, and personal daring were favorably combined in the California situation. The result was that California showed the world how.

The American River is a branch of the Sacramento. It comes down out of the Sierras and joins the parent stream at the city of Sacramento. Up the American River half a hundred miles is the spot where Marshall made the first discovery of gold in California. The entire course of the river was rich in gold bearing gravel. Thousands of individual miners worked it for all they could get by the methods they used.

Agriculture was developing. Lumber was needed. There was an abundance of big yellow and sugar pine timber all over the wooded slopes drained by the headwaters of the American River. A company was formed to get out the logs

and float them down to where a sawmill could be built.

An artificial waterfall was necessary to furnish power for the sawmill. A river dam and a diverting ditch were required to produce the fall. Water rights had to be obtained in order to divert any part of the river flow.

So the company bought a long strip of land from an old Spanish grant. It included the channel of the river. Then followed years of litigation and preparation.

The dam would cost hundreds of thousands of dollars and the canal a whole lot of cash. Where the dam was to be the river cañon was narrow and walled with granite.

California was gaining permanent population. A second penitentiary was needed. The state determined to have the new institution located where the convicts could be worked in a rock quarry. There were but two favored places. One was adjacent to that proposed dam across the American River.

Out of the procrastinating political evolutions of the time emerged an agreement. The state was to get a tract of 484 acres of the mill company's land along the American River. It was to give in exchange convict labor needed for the construction of the dam and a part of the canal.

The scheme dragged. Convicts worked for six years upon the masonry of the dam and the diverting canal.

The state also received the privilege of having the canal skirt the prison property and drop the immense volume of water seven and a third feet into the prison power house to produce electric energy. Trouble and more delays came from disputes as to whether the prison or the mill had the right to control the outflow from the dam. And litigation went on for 20 years before the final appeal was settled by the highest court.

At the prison they objected to the passing logs. All they wanted was the water power. But the lumber company had to have logs. Also the company had decided that a large power plant could be erected near its proposed sawmill. Industries would be lured there to take the power. A manufacturing town would

The Folsom Power Canal. At the left The Folsom Penitentiary, Granite Quarry and Power House

be developed. The water would be carried on and sold for irrigation purposes.

It is the steep pitch of the rivers running down out of these mountains that makes California such a wonderful place for the development of hydro-electric energy. Flanking every stream are great corrugated ridges out along the sides of which ditches can be made to divert the water for a fall of hundreds of feet.

The state prison figured on getting 800 electrical horsepower out of the little fall of the canal in the prison yard. The lumber and water company, with that vision of factory sites right near its power plant, decided to build big.

The river dam itself is a solid masonry wall of granite 81 feet high, sixteen feet thick and 854 feet from bluff to bluff of the river cañon.

The canal is two miles long, 50 feet wide, and carries a rapid flow of water eight feet deep.

The company's power house was to be built at the little town of Folsom, famous since 1855 as the site of the first railroad shops in the western part of America. It was also the temporary terminal of the first transcontinental railroad. From the very bricks of that historic railroad building were to be made the power house itself.

Behind the power house, constructed of granite, is a forebay reservoir 150 feet long, 100 feet wide and twelve feet deep, with a masonry partition to provide two equal sections. This arrangement permits the cleaning of one section to remove silt and sediment while the other section is supplying water to the turbines.

From this reservoir four huge steel pipes, each eight feet in diameter, let the ponderous columns of water plunge down a perpendicular distance of 55 feet and force the revolution of the four turbine wheels, each ten feet in diameter.

These water wheels, making 300 revolutions a minute, are connected to the armature shafts of the electrical generators. The outer rim of each wheel travels at the speed of nearly two miles a minute. Each wheel weighs 10,000 pounds. The centrifugal force is so great that a heavy steel rim is shrunken on like a wagon tire to preserve the

Famous Early Power Plant of Folsom. The 22-mile Line from this plant to Sacramento

Marked the Beginning of Long Distance Transmission of Electric Power

massive wheel from the strain of its natural tendency to fly to pieces.

While this substantial plant was being built a small installation for a mine in another part of California actually demonstrated that electric energy could be successfully transmitted a distance of thirteen miles.

But when the Folsom dam was started neither long distance transmission of electric energy nor a high fall of water for practical power purposes had ever been practically demonstrated.

At the time of its installation, that hydro-electric equipment in the Folsom power house was the most massive and powerful in the world, excepting only the plant at Niagara Falls. It weighed 400,000 pounds.

The Folsom plant was equipped to produce 6,600 electrical horsepower generated at a pressure of 800 volts and then increased through transformers to a pressure of 10,000 volts for transmission. Now it is sending out current at 60,000 volts.

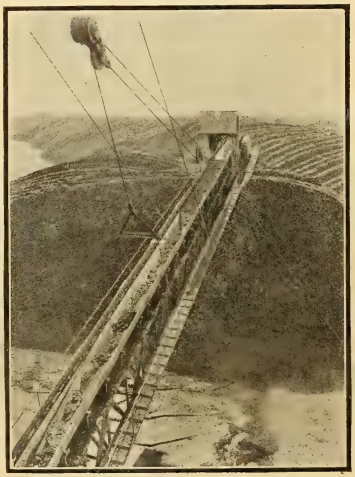
But even before the plant started generating electricity with that tremendous volume of water, dropped through what is now considered as a low head, other changes had come.

Now came to the owners of the dam a vision of taking their electric power on down to Sacramento and selling it to run cars and industries and light the streets and buildings. The people of the Sacramento steam power electric plant laughed at the idea. One of them facetiously offered to take into his own system, barehanded, all the current they could bring down as far as Sacramento.

But even while Sacramento, today a city of 50,000 people, was absorbing the power from the Folsom plant 22 miles away and using it for street cars and lights, other developments were happening. They were destined to connect the Folsom plant directly with the gold mining industry and once more make the channel of the American River yield its harvest of gold.

The idea of a gold dredger operated by electricity had recently been successfully tested in California. And the proven long distance transmission of electric energy made cheap power a certainty.

A gold dredge is nothing more than a large flat boat equipped with machinery for operating an endless chain of scoop shovels that dump rocks and



In the Wake of the Electric Dredge

mud and gravel upon the boat. A washing process and mercury plates secure the gold. The stones are carried off upon an ascending belt that dumps the debris on a high pile at the rear. A large, well equipped gold dredger costs more than $100,000. It is no tool for a poor miner.

But it makes placer mining a luxury. Very little water is required to float the boat. Some dredgers are constructed in a scooped out spot in a dry field. When all is ready and the electric power wire is connected with the motors that operate the machinery, water is piped in to form a tiny pond in which the boat can float and begin operations.

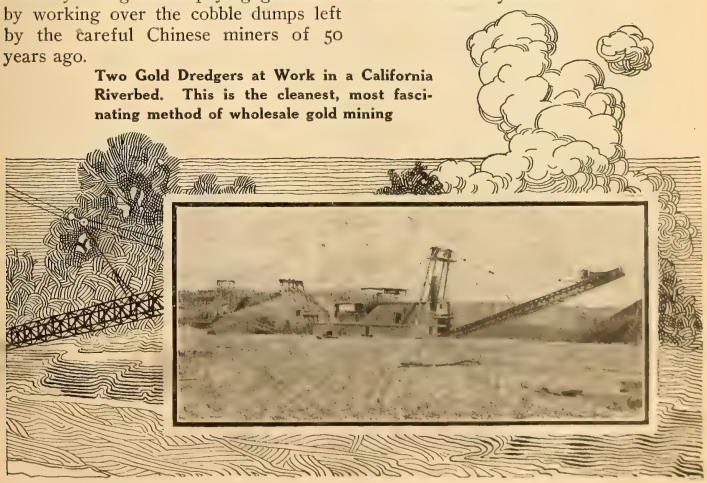
A half dozen men, including electricians and cook, constitute a dredger crew. The amount of work done by one dredger would make a regiment of old placer miners, accustomed to shovel-and-pan methods, look like an array of red ants trying to move a barrel of sugar a grain at a time.

The dredger scoops down to bed rock, sometimes 70 feet below the surface, and analyzes every square inch of possible territory. It gets out paying gold even by working over the cobble dumps left by the careful Chinese miners of 50 years ago.

The gold dredgers in California run day and night, with three shifts of men. Being well lighted, they work right along. Thus they are able to secure very favorable power contracts on account of this continuous load. At Hammonton alone, on the Yuba River, a few miles from Marysville, there are 30 of these huge dredgers working in one group.

And along the American River, between the Folsom power house and the city of Sacramento, the landscape is punctuated with the peculiar top works of dredgers craning above the apparently illimitable billowy rows of high piled cobblestones.

The gold dredger takes the whole river bed and the district a half mile or so on each side of the river. And it gouges down deep. What it does to the beauty of nature is almost unbelievable. Vegetation and every particle of soil and sand disappear from the face of the earth, being sluiced away into the depths and lost. Behind the dredgers are strewn in close furrows nothing but glaring, grayish cobbles and bowlders piled higher than an ordinary house.



Two Gold Dredgers at Work in a California Riverbed. This is the cleanest, most fascinating method of wholesale gold mining

Uncle Sam's EMERGENCY LINES OF COMMUNICATION

By Waldon Fawcett

As all persons who keep in touch with electrical progress are aware, the United States government has, for years past, made extensive use of the telephone and telegraph. There is, however, in this utilization a wheel within wheels that is little known, even to the electrical public. This is Uncle Sam's extensive and ever increasing use of emergency telephone and telegraph lines. All along the line of the Panama Canal, in the great reclamation, irrigation and conservation work in the West, in the development of Alaska, in constantly expanding military operations and in other equally important spheres the Federal authorities have found emergency communicative lines an indispensable aid, and, spurred by the possibilities disclosed, they have made bold to disregard the limitations usually supposed to obtain in the case of temporary installations of this kind.

Emergency telephone and telegraph systems, as the term is used

with reference to Federal projects, are of dual character. First, there are the emergency lines which are exactly what one might suppose from the designation; namely, wires installed in order that government workers in an isolated or remote region (removed from regular communicative facilities) may be kept in touch with the outside world and, more especially, with their bases of operations. Such lines are usually, at the outset, makeshift affairs, provided for temporary use, but, if circumstances warrant, this primitive plant is succeeded by one of more permanent and lasting character. In this category also should be included, probably, the temporary telephone and telegraph lines which are provided by United States military forces operating in the field on the occasions of maneuvers or "hurry calls," such as the recent mobilization of troops on the Mexican frontier.

The second class of emergency lines provided by the government are those which are designed for use in case of emergencies, but the presence of which does not necessarily imply quite the same pioneering or prospecting conditions that we are apt to associate in our minds with the first mentioned division of emergency systems. In this second division are such electrical nerve systems as the telephone and telegraph wires whereby Uncle Sam's forest rangers give warnings of forest fires and summon assistance. Likewise the wire meshes which encompass the vast irrigated areas that Uncle Sam is developing in the West, these particular lines being designed to allow the prompt sounding of an alarm when a canal breaks or a dam gives way under flood conditions. Such emergency lines, like those in the first division, are originally installed by Uncle Sam, but there is this difference, that in the case of the second class of emergency systems it may be advisable as the country develops and fills with settlers for the government to turn over the telephone and telegraph chains to private enterprise, or, preferably, to co-operative organizations of local residents.

In no branch of our governmental activities has the telephone exerted a more revolutionary influence than in the Bureau of Forestry which is charged with the care and management of our great national forests. The Secretary of Agriculture and the United States Forester after going over large areas of little developed and almost unexplored national forest land, came to the conclusion that systems of telephones with proper connections would be invaluable in the wilderness regions of the West. What rapid progress has been made in the conquest of the solitude is evidenced by the fact that there are now 7,381 miles of telephone line in the national forests and this is being increased to the extent of hundreds of miles of new construction each year.

Yet the officials feel that the work of establishing telephone lines as the most important adjunct of the protective patrol system of the forests has been hardly more than begun. The newest idea is to carry the telephone wires to "lookout towers" established at strategic points in the forests. A man stationed in the tower scans the landscape in every direction with powerful glasses at frequent intervals and if he discovers anywhere in the two or three hundred thousand acres under his observation the tell-tale smoke of an incipient forest fire he quickly gives the alarm by telephone. During the past year the officials of the Forest Service have discovered that, as a supplement to the permanent telephone lines, temporary lines of insulated copper wire can be laid cheaply and rapidly. Insulated wire, weighing less than 30 pounds to the mile, is carried on a pack horse to any point from which it is desired to extend an existing line temporarily, and the insulated wire is then laid on the ground. This expedient has proven entirely successful for distances up to 60 miles.

There is no field of either governmental or private enterprise that has ever

GOVERNMENT
EMERGENCY
TELEPHONE
LINE IN
ARIZONA

been more absolutely dependent upon emergency telephone lines than is the United States Reclamation Service in its task of transforming the deserts. Indeed, as a rule, the very first step in undertaking any new irrigation project has been to install a telephone line, for the undertakings have almost invariably been in wild and sparsely settled country where there were no existing lines of communication and where the telephone or telegraph had to be depended upon to keep supplies moving and enable the directing engineers to receive reports from the crews working in more or less widely separated localities. At the outset such wires often have pole supports of a very primitive type but latterly, when power generation is attained on the projects, the wires are usually carried on the towers of the transmission lines.

The Reclamation Service now has in service nearly 1,700 miles of telephone line but oddly enough this wire system serves less than 800 telephones, an average of only one telephone for more than two miles of wire. As the projects progress the telephone systems will be extended until the lines parallel all the main ditches of the great waterways systems and the "ditch walkers" will have at hand the means of almost instantly communicating the discovery of any break in the ditches or other mishap that would involve loss of the precious water. Of course, as settlers come in and take up the land under irrigation the number of telephones will grow until the present ratio of a few telephones to many miles of wire will be reversed. The longest single telephone line in the Reclamation Service's emergency system is in the Southwest and has a length of approximately 100 miles.

The United States Army, through the United States Signal Corps, makes extensive use of emergency lines, both telephone and telegraph. During the army mobilization on the Texas border (the first opportunity which has been afforded for a practical try-out of its latest approved equipment) this institution accomplished wonders in the rapid installation of communicative lines and established under canvas field telephone and telegraph offices that were models of the kind. Much of the credit for the speedy work of installation unquestionably belongs to the improved types of wire carts which have lately been perfected by Uncle Sam's experts—one type designed to carry two reels of wire and the other a single reel of wire.

The War Department maintains in Alaska a full-fledged telephone and telegraph system that may rightfully be designated an emergency installation. It comprises fully 1,125 miles of land line, in addition, of course, to the submarine cable that connects this country with Alaska, and the problem of keeping these lines open in the winter months is one of the most perplexing ones that confront the men in charge of Uncle Sam's electrical "intelligence system."

Safe Expert Uses an Electro-Magnet

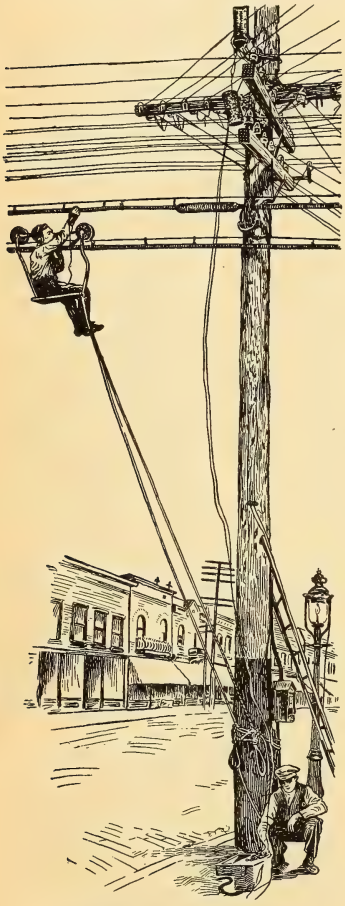
A bank in an Illinois city recently had some trouble with the time locking device of its huge 60 ton safe, of the type in which the clock inside the door controls the expanding rings which lock the door.

An expert was called in, who, after making the repairs and locking the safe, accidentally dropped a small screw into a hole in the top of the door, while replacing a part of the controlling device. This screw dropped down far into the interior and lodged between two levers, preventing the unlocking of the door.

After working all day to get it out, he gave up the job. Then some one suggested a magnet, and one was constructed by a local electrician. It was made with a small iron core, a few turns of magnet wire and a few cells of battery. This core was dropped down into the opening and after a half hour's work the screw was fished out.

Exploring Cables with the Telafault

Inside the lead sheath of an aerial telephone cable are several hundred pairs of fine wires all carefully insulated from each other. Each pair represents the line to some one's telephone. Now suppose lightning gets into the cable and puts a cross on some pair of wires or causes a high resistance ground between a wire and the lead sheath, or suppose an opening develops in the sheath and moisture gets in and ruins the insulation. These things are liable to happen, and how are you going to locate the trouble? The usual way is to locate trouble as nearly as possible by certain electrical measurements from the nearest open point on the cable. The point of trouble can only be located approximately in this manner. Then it becomes necessary to begin and open up the cable sheath at frequent intervals in each direction to test. In this manner the exact point of fault is finally found. But the method is slow and laborious.



EXPLORING WITH THE TELAFAULT

The most up-to-date method is to use a little instrument called the "Telafault." After the fault is first located approximately, as in the above case, the man on the ground, through a set of portable instruments, places an intermittent current on the line in trouble. The overhead man then works along the cable with a little exploring coil connected to a head telephone receiver. The intermittent current causes a buzzing in the receiver, but at the instant it passes the fault this buzzing ceases and this is the place for repairs, and only one opening is thus necessary.

Electric Vehicles and Horse Feed

The following figures were compiled recently by one of the electric vehicle journals: During the last five years the cost of oats has increased eleven per cent, the cost of corn has increased sixteen per cent, the cost of hay 24 per cent, and the cost of horses 100 per cent. Within this period the cost of electric vehicles has decreased remarkably and the efficiency of the electric truck has increased 25 per cent.

Some SECRETS of Electrical Stagecraft

By T. J. Newlin

PART III

"SHADOWS" FROM THE UNDERWORLD

Now for a few words about "specters." Close your eyes and challenge the memory centers of your brain or subconscious sense to draw from its innermost recesses the most weird, uncanny ghost, hob-goblin or what-not you have ever, in your imagination, had the fortune or misfortune to gaze upon. For I am going to delve deep into the optical art of the magician and explain a wonderful optical illusion sometimes employed by clairvoyants to play upon your imagination, and in such a manner as to cause an hallucination vivid enough to hark back for a decade and rattle the bones of the family skeleton with jealous envy. Before doing so, however, I will say a few words on those unpleasant visitations known as ghosts, to which all people are liable, either through an overworked brain or some organic disease.

The peculiar appearances known as specters in optics are certain illusions of vision in which an object is apparently presented to the view which does not really exist. In such cases either the brain, the retina, or the optic nerve are unnaturally excited and made sensitive to an appearance that, physically speaking, does not exist. There is such a close connection between the senses and the mind that we continually, and without knowing it, transfer to the physical world that which belongs to the domain of thought. A picture which has struck us during the day will appear to us at night during sleep, with every detail perfect, or possibly under a form modified by the capricious wanderings of our thoughts. A sudden fright may sometimes be the cause of optical illusions which will pursue us unceasingly.

Fear, despair, passion, ambition, and other violent mental phases are capable of evoking images closely connected with the state of our brain, appearances that we often take for realities, and the truths of which we have to test by our faculty of reasoning, before we can set them down for positive illusions. In fact, we have the cases of Newton and Napoleon as examples of where the imagination revives the images of luminous objects for months or even years after these impressions took place. Napoleon was often found gazing at a supposed bright star which he imagined was leading him onward to victory, but which suddenly went out at Waterloo.

After the occurrence of such phenomena, it is easy to comprehend how shallow is the division that separates reality from the spectral illusions.

Specters may be divided into two classes: the subjective, which are caused by some unnatural action of our bodies and which belong to the science of physiology, and the objective, which are caused by some peculiar illusion acting from outside forces. In many known cases of the power of imagination over the life of the body it has been shown that the power of judgment is destroyed, so great is the terror of the unfortunate sufferer. Even men with the strongest nerves are not free from such illusions.

The most fascinating and mysterious specters, in which the science of optics plays so important a part, are the re-

FIG. 17. A STAGE GHOST AS VIEWED BY THE AUDIENCE

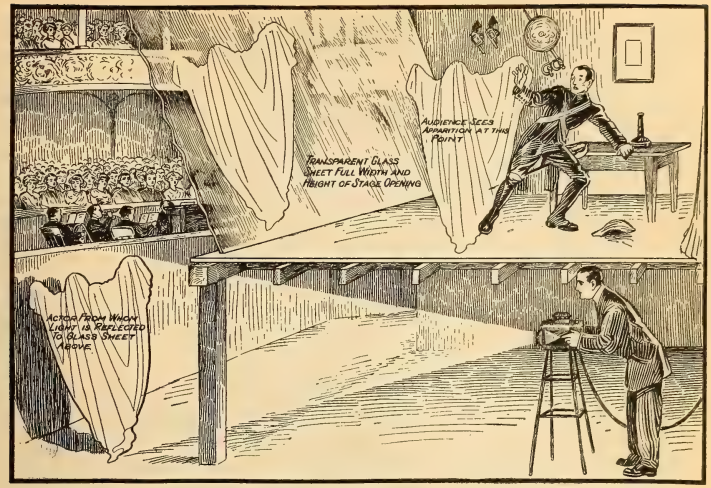


FIG. 18. METHOD OF PRODUCING THE GHOST BY MEANS OF A GLASS SHEET AND REFLECTED LIGHT

sult of the imagination being deceived by art with the assistance of science.

THE GHOST TRICK—AN OPTICAL ILLUSION

Specters form the principal part of the ghost trick which has been practiced at various Parisian theaters for a number of years, more especially at the Théâtres du Châtelet and Dejazet. The Adelphi of London also employed Mr. Pepper to heighten the effect of the excellent acting of Mr. Toole and Mrs. Alfred Mellon, in the dramatic version of Dickens' "Haunted Man," by the introduction of various spectral effects. And the same trick was called into requisition with success in several of the New York theaters. At the Polytechnic, London, very remarkable effects were produced and few who ever saw them will forget the surprise they felt at seeing the first representation of an imponderable ghost endowed with motion and even speech.

Among the most successful productions in this way was the entertainment of M. Robin, successor to Robert Houdin, the prince of prestidigitators. Evening after evening he not only "called spirits from the deep," but "made them come." He pierced them with swords, he fired pistols through them and made them appear and disappear at will. He showed the Zouave at Inkermann, lying dead amongst a heap of slain, who at the familiar sound of the drum, rose, pale and grave, and showed the bleeding wounds from which he died. Among other scenes shown was one of a specter appearing to an armed man, who after trying in vain to shut out the vision from his sight fired a pistol at the intruder. Fig. 17 shows the scene as viewed from the audience, and Fig. 18, the method by which the illusion is produced and operated. In the latter the theater is shown in section. On the left, at the end, are seen the spectators; on the right is the stage upon which the scene is represented. Beneath the stage is the actor clothed in white to personate a ghost whose image is reflected by the glass above. The glass is placed at an angle and fills up the whole front of the stage.

the edges being carefully concealed by curtains. The glass of course must be of a very large size and should be of the very best quality, so that it cannot be seen by the audience. The actor must take care to place himself in such a position as to counteract the effect produced by the glass being placed at an angle.

At first the cavalier is seen sitting at a table. After soliloquizing for a time in a very remorseful manner, touching several murders that he has committed, the ghost of one of his victims gradually appears. This is effected by gradually turning the electric light upon the concealed actor. The murderer and victim parley for a short time, when the former, unable to withstand the reproaches of the ghost any longer, fires a pistol at him point-blank. The ball of course takes no effect, so the villain draws a sword, but before it has left its scabbard the spirit of the victim has vanished with a mocking laugh, or, in other words, the electric light is suddenly turned off.

The management of the light is exceedingly difficult under the circumstances. The theater, the stage and the portion beneath ought to be lighted in a very careful manner, for if either is too bright or too dark it mars the whole effect.

It must be remembered, too, that the person performing the part of the specter and the real actor above cannot see each other, consequently all the action has to be carried on by guess work. The actor below has to walk along an inclined plane, keeping himself exactly at right angles to it.

When well arranged, the ghost trick leaves far behind all the efforts of a similar nature that were obtained by the ancients in the way of magical illusions. It is also incontestably true, contrary to what some people have supposed, that they were unable to perform this illusion in the way it has been described, for they were ignorant of the method of manufacturing and polishing glass plates of sufficient size and clearness for the purpose.

The production of living but impalpable specters is thus an entirely modern achievement, as we have already proved, and which has taken its place among

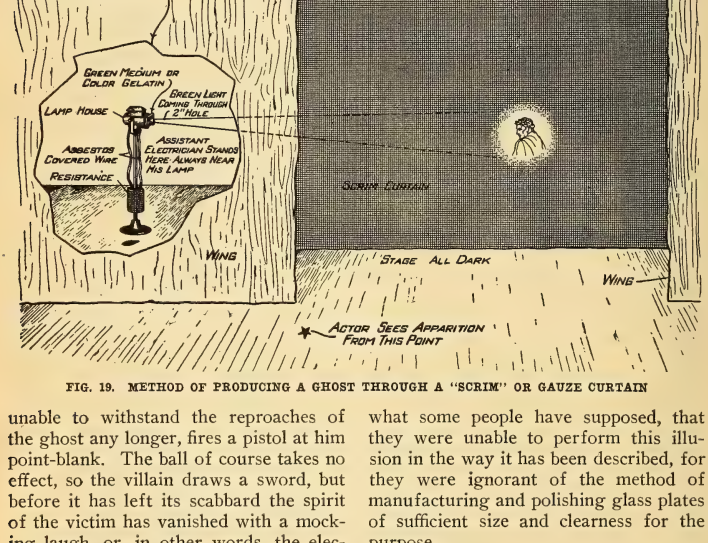


FIG. 19. METHOD OF PRODUCING A GHOST THROUGH A "SCRIM" OR GAUZE CURTAIN

the applications of science to stage art, to the total exclusion of all effects depending for their production on the old-fashioned phantasmagoria and magic lantern.

"GREAT CÆSAR'S GHOST"

This expression you will often hear as an ejaculation or exclamation of surprise, so I am going to explain just how you can cause him to gallantly walk forth and greet you in all of his ghostly majesty. This method is unlike the more elaborate one just described, as it is by far more simple. The easier way to produce a ghost effect is like that adopted by Mr. Robert Mantell, the eminent Shakespearean actor. Mr. Mantell as Brutus, the assassin of Cæsar, has a very nicely acted scene with his ghostly lordship. Just before the battle of Philippi the ghost of Julius Cæsar appears, and in the most hollow and sepulchral tone of voice the apparition informs Brutus it will visit him again at the battlefield. In his great stress of mind at the irreparable loss of his lovely wife and the burdensome affairs of State, he gives orders for the army to march on Philippi and in desperation meets his inevitable fate as prophesied by the ghost of Cæsar.

FIG. 20. "GREAT CAESAR'S GHOST" AS PRODUCED BY THE "SCRIM" METHOD

CÆSAR'S GHOST BY THE "SCRIM" EFFECT

In Fig. 19 is shown the method by which the ghost scene is produced. A "scrim" or gauze sheet is interposed between the actor and the ghost. The stage is dimly lighted by blue foot and border lights dimmed down one-half. The assistant electrician is to the left of stage masked from the audience by a projecting wing and operating an electric arc lamp, which throws the light upon the apparition as shown in the cut. This wing is situated behind the scrim or gauze sheet and separates both the electrician and the ghost from the actor, who is in a position in front of same and in full view of the audience. At the given cue a green light from lamp is thrown upon the actor characterizing "Cæsar's

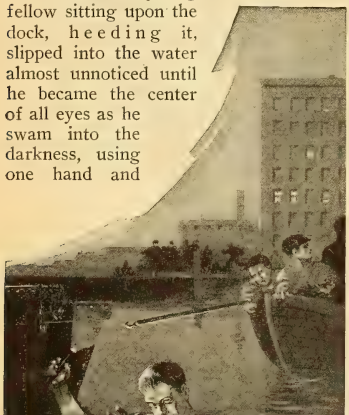
Ghost," taking care to light up the head only. The stage being dark and with light shining on the ghastly features, the rest of the body is in total darkness and absolutely obscured; while the audience through the scrim sees the pale, death-hued face of the murdered Cæsar, as in Fig. 20, which gradually dissolves and fades from view as the light is masked off. In this effect the real body is shown instead of an electrical or optical illusion; and so, of course, is not supposed to be fired upon or run through with the sword.

In the next chapter of this series, which will appear in an early issue, besides describing the production of the "Lightning Bolt" in King Lear, the author will take up the production of stage illusions, through applications of the science of optics, particularly the simulation of moon effects, rainbow effects and the separating of colors by the prism. The wonderful, fascinating Sciopticon for the production of luminous images will also be treated in detail.—Editorial Note.

Flashlight Directs Night Rescue

A spectacular rescue from drowning in which a cool head and an electric flashlight played the prominent parts took place recently in the river harbor of a big city.

An ocean steamer lay at the dock one evening with other smaller craft near by. There was suddenly a cry of "Man overboard." A young fellow sitting upon the dock, heeding it, slipped into the water almost unnoticed until he became the center of all eyes as he swam into the darkness, using one hand and waving above his head with the other hand an ordinary pocket flashlight. Reaching the almost exhausted victim, the uplifted light now directed the throwing of a life preserver and a quick rescue.



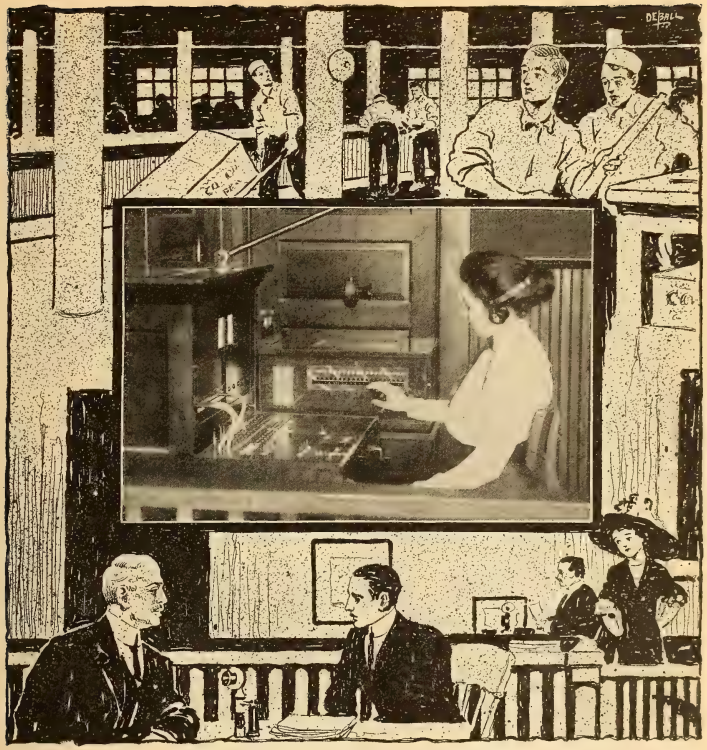
A SPECTACULAR RESCUE

Steam Versus Electric Transportation

Through a small suburb of Chicago, the steam and electric railroads run parallel with each other, the depots for the village being only half a block apart. A number of the electric road's patrons, who cannot but admit its superiority in the good weather months, usually change to the steam road on account of a supposed more reliable service during the winter months. But the severe weather of the past winter has entirely disproved their assertion, as the electric railway's schedule was maintained within about ten minutes of its regular time during the heaviest snowstorms and coldest weather, while the steam railroad was considered to be doing well if it ran anywhere within one to 2½ hours of its regular schedule.

The Autocall

A new device termed the Autocall has recently been installed in many large factories as a means of locating instantly officers and employees whose duties carry them all about the works. The device looks very much like a small telephone switchboard and is usually installed near the operator of the branch exchange.



THE AUTOCALL AS THE FACTORY MESSENGER BOY

A number of ringing stations are located at convenient intervals in the factory and each employee, foreman, superintendent, etc., who may be wanted for any purpose has a prearranged signal of long and short dots and dashes, much after the style of the Morse code. The wires from the ringing stations converge at the central board and terminate in the central Autocall board. When a party is desired the lever shown on the front of the central board is moved along until it comes under the notch of the individual wanted. Then the lever is depressed and the call is simultaneously sounded throughout the works. The party called hears his signal and gets the office by telephone to know what is wanted.

The system is entirely separate and distinct from the telephone system and by an ingenious contrivance the call is insistently repeated at frequent intervals automatically. This system has been installed in many large established factories and gives almost universal satisfaction as it obviates the disturbance necessary in calling up department after department to locate a party wanted.

The Pulmotor

The load dispatcher's office of a big electric light and power system is the point from which, night and day, the operation of the system is directed. And this is the reason for placing on the table in this office of the Commonwealth Edison Company of Chicago a plain wooden box the size of a suitcase. Within this box is a device called a pulmotor, a machine that works marvels in reviving persons who have been shocked by electricity or suffocated by gas. The telephone bell rings and the hurried query, "Is this the load dispatcher's office?" may come at any moment, followed by "This is Dr. ——. I have a bad case of asphyxiation."

That is enough. The dispatcher knows that the life saving pulmotor is wanted.

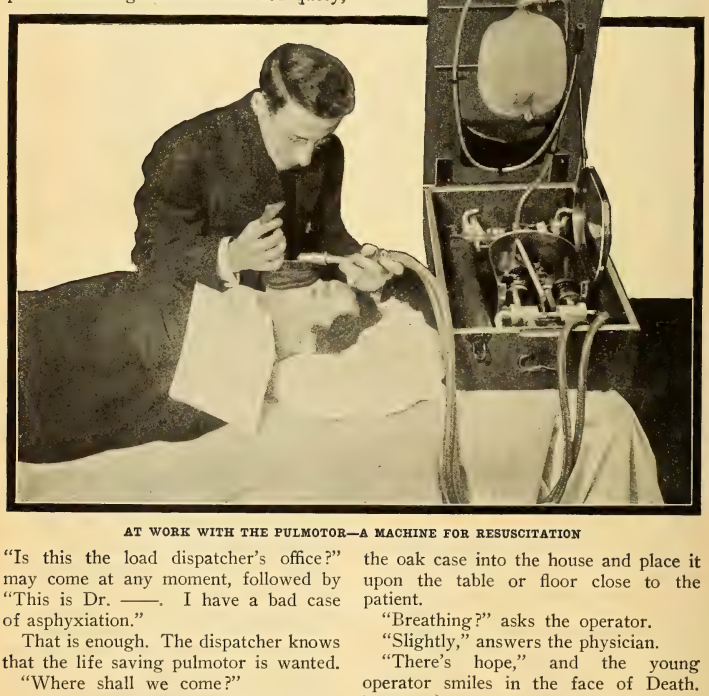
"Where shall we come?"

"To No. ——, —— street."

"We will be there in eight minutes," is the dispatcher's answer.

In less time than it takes to write it, two men appear in the dispatcher's office. One seizes the handle of the ordinary looking wooden box while the other leads the way to the elevator and in a minute's time, seated in an automobile kept for this special service, they are racing with death, for the loss of two or three minutes or even less may mean life snuffed out by gas.

As the speeding automobile draws up to the curb, both men spring out, carry the oak case into the house and place it upon the table or floor close to the patient.



AT WORK WITH THE PULMOTOR—A MACHINE FOR RESUSCITATION

"Breathing?" asks the operator.

"Slightly," answers the physician.

"There's hope," and the young operator smiles in the face of Death. The race is almost won.

The cover of the case is opened, a sort of a face cap with a soft rubber rim is connected by two rubber tubes to the

29.369

apparatus and then placed over the mouth and nose of the patient. In the face cap is also a small rubber bag which enables the operator to grasp the patient's tongue with a pair of forceps and hold it in such a position as to give free access to the lungs. Now touching a lever the pulmotor begins pumping. In the box is an iron cylinder 3½ inches by 21 inches containing oxygen at a pressure of 2,800 pounds. By the operation of valves, bellows and pistons, oxygen mixed with air is forced into the patient's lungs and drawn out again. This operation is repeated several times a minute, depending upon the lung capacity of the patient.

Presently the patient shows signs of breathing. This becomes more marked until the chest rises and falls with regularity, the fingers twitch, the arms may move slightly, and a life has been saved.

The pulmotor is the latest step of science in coping with death caused by asphyxiation, electric shock or poisoning; in fact, it is used in all cases where respiration has been suspended or restricted.

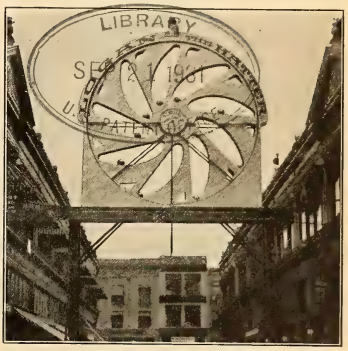
It was introduced in Chicago by the Commonwealth Edison Company about eight months ago to be employed in cases of severe electric shock, but the device has been widely used in gas and poison cases.

From January 16 to and including February 29, the pulmotor has been hurried out to treat 67 persons. Of this number 34 were brought back to life, sixteen were revived while the machine was on its way, two were not pulmotor cases and fifteen were dead before the arrival of the machine. The longest time the pulmotor was ever used and was successful was two hours and 20 minutes.

The Commonwealth Edison Company has in all cases sent the pulmotor without charge of any kind. Three more machines have been ordered and will be placed in various sections of the city to reduce to the minimum the interval of time between an accident and the arrival of the pulmotor.

Puzzle: Find the Motor

A so-called "perpetual motion machine," erected over one of the side streets of Los Angeles, California, rotates day and night and attracts the attention of passers-by to the advertisements painted upon it. The inventor claims, or allows it to be assumed, that



A "PERPETUAL MOTION" SIGN

the rolling of the large brass balls from centre to periphery produces enough power to maintain the wheel always in motion, but those observers who were skeptical were rather amused to note that the wheel ceased its motion when a large fire in the neighborhood caused the electric current to be interrupted.

Changing Song Slides

In some moving picture theaters it is very difficult for the operator in the booth to hear the singer and know when to change the slides. The following arrangement will work very satisfactorily: Place an ordinary telegraph key on the floor just to the left of the pedals of the piano. Four dry batteries in series with the key and connected to a four volt lamp in the booth by a No. 18 drop cord will enable the piano player or singer to press the key with the foot and flash the lamp in the booth.

Telephone in Timing Motor Boats

Modern motor boats which are propelled at almost express train speed are hard things to time in races. Owing to the high speed, the course is necessarily long and the usual method of firing a pistol and having the man at the finish line catch the flash in starting his watch is not satisfactory. The most approved method is to use the telephone in connection with a submarine cable, which has been tried with success in at least one big race.

A submarine cable is laid between the wharf or barge at the starting point and the boat at the finish, connecting telephone instruments at the two points. When a motor boat is brought up to the starting line and all is ready the starter fires his pistol in front of the telephone transmitter, starting his watch at the same instant. The judge at the other telephone also hears the pistol and starts his watch. Then when the boat arrives at the finish line the judge of the finish takes the time and announces the exact moment through the telephone to the starter. In this way there is a double check, as two watches are held on the contestant.

THE JUDGE AT THE FINISH HEARS THE SHOT

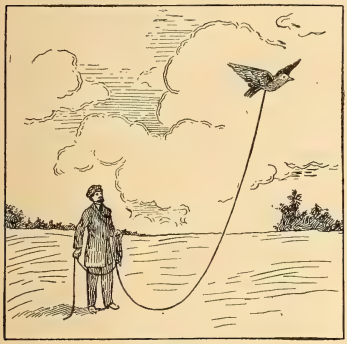
THE STARTER FIRES HIS PISTOL IN FRONT OF THE TELEPHONE TRANSMITTER

Chicago-New York Business Trip Without Going Out of Doors

A big hotel will be built this year in New York, by the New York Central and the New York, New Haven and Hartford railroads. When it is completed it will be possible for a person arriving from Chicago on the Twentieth Century to disembark at the Grand Central Station, take an elevator to the lobby of the hotel, and then proceed to his room without going out of doors. He can take a Turkish bath, eat his luncheon and then go to Wall Street by the subway, transact his business in one of the big buildings adjoining the subway station, go back to the hotel, and return to Chicago, without stepping his feet upon the pavement of New York.

Bird Aeroplanes

The soaring flight of birds has always been one of the secrets of the air. The Wrights have been experimenting along these lines with some degree of success, and Lilienthal sacrificed his life in his endeavor to solve the problem. M.



BIRD AEROPLANE

Briane, a French aviator, is using unique methods in striving to solve the riddle. He has constructed a model aerodrome and is experimenting with bird models. One of his recent experiments was the construction of a 1-20 horsepower electric motor so small that it could be used in the body of a crow, supplying power for the crow's soaring flight.—*Mechanics for Everybody.*

An Immense Projecting Sign

A novel electric publicity device which is designed to be operated from the roof of a large building is called the Stero-Spec-Funnel-Ad-Scope. It is a sign of the projecting lantern type, but on a very large scale. The little house at the left contains the projecting lantern in which various slides are used. These slides are projected boldly, and in colors if desired, out on the large screen placed where it can be seen far up the street.

PROJECTING SIGN

Sign that Stops Traffic in the Strand

Electric signs are not used to nearly such a great extent in England as in America, consequently they attract even more attention than in our own cities. The sign illustrated in the cut, which

SIGN THAT STOPS TRAFFIC

appeared on a London theatre, soon became known as "the sign that stops the traffic in the Strand." It is the type of sign which is more or less common in our large cities, and represents one clown throwing balls to another, who catches them and places them one by one on the table. The second clown then takes them off the pile and throws them into the word "Cinema," until this part of the sign is fully lighted. The process is then repeated.

The first night the sign was in operation complaints were made to the police on account of the crowds who collected to watch it, and for a number of weeks it was necessary to keep a man on the roof to turn off the current as soon as a crowd collected.

ELECTRIC VEHICLES

FOR BUSINESS AND PLEASURE

by

W.C. JENKINS

PART IV.—COMMERCIAL ELECTRIC VEHICLES

The electric truck is distinctively a modern creation. It, however, is but the natural evolution of the pleasure vehicle into a more useful and valuable utility.

The gasoline vehicle builders quickly arose to the need of a small delivery wagon, at a reasonable first cost and large numbers of these gasoline delivery wagons suitable for the use of the butcher, baker, grocer and similar merchants were rapidly introduced.

The electric vehicle manufacturer has been somewhat handicapped in getting the electric truck into general use because of the first cost being somewhat higher than the gasoline wagon. A great many central station men have complained of the high price charged for electric trucks, but it must be remembered that the vehicle manufacturers have had the burden of a great many years of hard work to bring the trucks up to their present standard of efficiency and reliability, and that the trucks sold to date have not been in proper proportion to the builders' original investment expense. The builders claim that as soon as the central station men mastered all the details of the electric vehicle proposition, as they have mastered the power supply business and the sale of current to other consuming devices, then the price of trucks may be materially reduced.

Central station companies are coming to the front very rapidly in their efforts to encourage the use of electric trucks, and current rates for this class of service are being reduced each year. A little study of the question will show why this is so. In the operation of any light and power plant it is obvious that the load is not constant throughout a 24 hour day. There are times, in the morning and evening especially, when the load climbs up enormously. The daily load when plotted in the form of a curve runs up into enormous peaks. This means that expensive machinery and equipment must be provided to supply current during the leaks, a large part of which must lie idle during the period of low load. The electric supply companies are, therefore, constantly on the lookout to secure business which will come on to the lines during the low load periods, so as to keep the machinery busy earning money. In other words, they are seeking day and night to flatten out that load curve. To secure such business they make better rates. Practically all the companies are now following this plan.

The charging of electric truck batteries furnishes exactly the kind of load

that the central station is seeking. The logical time to charge the batteries is during the night when the trucks are idle. Fortunately this is the time when the central station load is at its lowest ebb and special rates can be made.

There is a field for a small electric wagon of from 500 to 750 pound capacity which would come between a pleasure vehicle and a 1,000 pound truck. This sized vehicle would be of a great convenience to the small tradesman and could be furnished to the electric light companies and dealers in general at a price that would not scare a prospective buyer.

This type of a wagon would be a proper thing for a small central station to start an electric vehicle campaign.

It may be stated, without qualification, that the development, perfection and production of the electric commercial machine is now being backed up with the same quality of sound brains and capital responsible for the development of many other electric utilities which have become necessities in our daily life.

In establishments where power is usually produced at low cost the electric vehicle fits in so harmoniously as to require very little argument in its favor. There is, in such concerns, a quality of mechanical ability quite competent to care for the electric truck, and its simplicity of control renders available several operators for each machine, thereby insuring almost constant service.

An economical feature of the electric vehicle is that when the machine stops or is delayed at shipping depots, its cost of maintenance also stops, which is not the case with the horse employment.

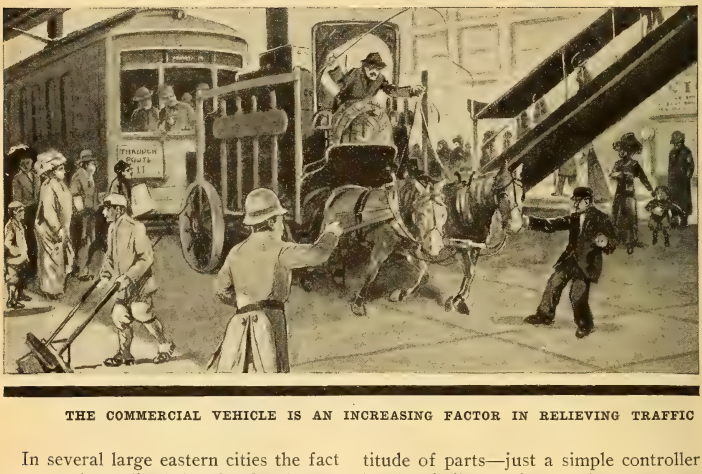
One peculiarity in machine performance has not been realized by the average person, and this is that the consumption of current, tires, gears and battery material is in direct proportion to the work performed, and that periodical renewal of such consumed material is as much an essential part of the program as is the renewal of horseshoes, wheel tires, blankets or any similar material requiring constant renewal with horse service. The periodical renewal of this consumed material does not indicate the gradual breakdown of the entire vehicle, because the machine proper undergoes very slight wear and the annual depreciation is less than ten per cent.

No one endowed with ordinary judgment can impartially consider the constituent makeup of an electric machine without recognizing that it is composed of the least number of parts that it is possible to incorporate in a self-propelled vehicle. It is a simplified street car with the same motive power, equally reliable and free from restriction as to mobility and direction, with mechanism entirely devoid of reciprocating parts.

As pleasure vehicles they may be operated by children and as commercial machines with a class of labor but little if any more expensive than that employed with horse vehicles. They can be made to perform their specific day's work uninterruptedly and receive a fresh supply of energy silently during the night and operate with the same automatic precision as an adding machine or a cash register.

The user has the satisfaction and assurance that the power equipment is no haphazard arrangement, but is a well ordered development and natural production of such large organizations as have provided most of the street railway, lighting and power plants of the country.

Electric trucks may be found today in almost every industry where the conveyance of persons or goods is required. They are used as police ambulances and patrols, hospital ambulances, banking wagons, tower and emergency wagons for electric light and railway companies, pumping wagons, hoisting and derrick trucks. Besides they are used for fire departments, insurance patrols, hose wagons, chemical engines and supply wagons.



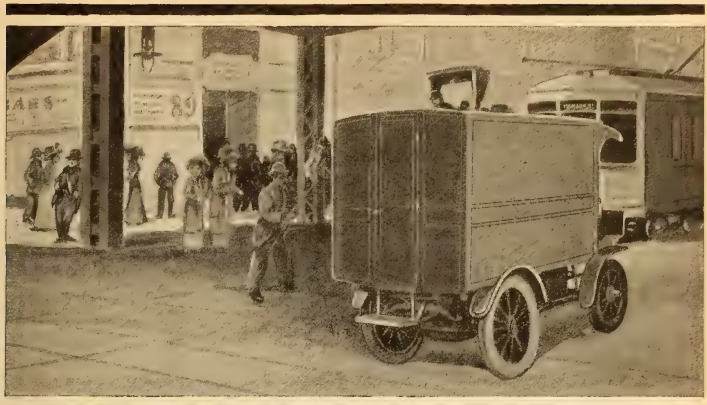
THE COMMERCIAL VEHICLE IS AN INCREASING FACTOR IN RELIEVING TRAFFIC

In several large eastern cities the fact seems to be realized that for fire departments the electric vehicles are especially fitted. This is largely on account of their efficiency, cleanliness around the fire stations, the absence of fire risk, simplicity of operation and general economy. In regard to fire risk there is no comparison with the gasoline cars. Everybody knows that many fires are daily reported which are directly traceable to the gasoline driven machine, and it would seem that fire departments should be the first to adopt a vehicle that would minimize the fire risk, especially when it can be done without deteriorating the efficiency of the department's service.

With respect to reliability the electric vehicle is unquestionably the most dependable. It is not freakish, is always ready to start and requires no cranking. Its simplicity is one of its strongest points. There are no reciprocating parts to shake the chassis and machinery apart; no engines with their multitude of details; no carburetors; no oil tanks; no clutches; no reversing levers; no transmission gear cases filled with a multitude of parts—just a simple controller handle similar to that on the street car, which in turn throws on the amount of current for the speed desired, either for forward or backward motion.

The efficiency of the electric vehicle has probably nowhere been better demonstrated than in San Francisco, where a test was recently made on one of the city's steepest hills. The Fillmore Street hills were chosen, not only because of the fact that no electric vehicle had ever climbed them before, but also for the added contrast between the power of the electric auto and the electric trolley car, which on this street has to be hauled up the hill by the old cable system. The electric car made a standing start from the foot of the hill and continued without pause to the top. It was then turned and coasted down the hill, making several stops to show the efficiency of the brakes.

The chief obstacle to the introduction of the electric truck is the plain conservativeness of the horse owner, and the presentation of the facts to that individual is the only means by which the central station industry and the manufac-



CONGESTION IN CITIES—A POTENT AID IN THE PREVENTION OF CRUELTY TO ANIMALS

turers of vehicles and their equipments can reach the goal of profitable off peak loads, extended sales and economic installation.

The electric truck is a machine capable of doing more under favorable conditions than can be handled by horses. It is more reliable, advertises its owner and frequently shows a return of 30 per cent on the investment when compared with the system of horse usage. It is free from dirt and odor and is capable of doing a full day's work on one charge of the batteries with a margin to spare. Many supporters of the electric vehicle have argued that good street conditions are necessary for its successful operation. It is perfectly true that an electric vehicle will not travel as many miles in one day under conditions of severe grades as it will on a level road, but the successful operation of the electric truck in many hilly cities has convincingly proven its superior advantages in this direction.

During severe winter storms the electric auto has on many occasions demonstrated its superiority—as the large electric truck as well as the pleasure vehicle find no difficulty in getting around. On the cleaned streets running is easy and even when the deep snow remains they go through apparently with but little additional effort. It has frequently happened that an electric truck was able to clear a block due to a stalled horse drawn truck. The electric drawn truck is under much better control than any other type of vehicle. It can start slowly and graduate its acceleration as desired.

The machines are thus able to meet most successfully the strain due to heavy snow, and they show no effects of the increased strain, except a somewhat increased rate of battery discharge.

The delay to traffic caused by horse drawn vehicles during winter storms is often very costly to the business interests of every large city. It is also a matter for humane consideration. The poor animals suffer not only from the excessive strain of hauling, but from frequent bad falls.

The electric pleasure vehicle has already displaced thousands of horses, and the modern electric truck is now coming into favor so fast that it will not be long until horse drawn vehicles will be the exception, and when we see the thou-

sands of horses still plodding along our streets we can realize the tremendous demand there will be for the product of the central station when these changes are made.

All the Edison companies are pushing the electric vehicle to the front. Many of them have large garages for the care of their own machines and have discarded horse drawn vehicles entirely, doing their heavy trucking as well as making their business calls by the use of electrics. In this way they not only set an example to the public, but find that they save money.

It is considered a fallacy to drive an electric truck faster than eight miles an hour, except when the streets are in excellent condition. The possibility of handling trucks of a larger capacity than five tons is merely a question of tire maintenance and the making of a vehicle that can be safely handled in our crowded streets. The present cost of the upkeep of rubber tires on 7½ to ten ton vehicles is so high that lighter trucks would, undoubtedly, prove less expensive in the total cost of the delivery of merchandise.

The use of electric motor trucks for railroad station work has made wonderful headway since the Pennsylvania Railway experimented with the scheme three years ago. The application of motor trucks for this class of work may be classified as follows:

Tracks utilized to replace box cars in the transfer of freight between different stations in the same city; trucks to replace horse drawn vehicles in the transportation of both passengers and merchandise in the public highways; trucks to replace manual labor in the handling of baggage and mail in large stations; machinery and supplies in railroad shops and in the large freight and transfer stations.

The transfer of freight between two stations, when accomplished by electric trucks instead of box cars results in quicker service, more available platform area, more useful truck space and more box cars available for freight transportation.

When we consider that the employment of electric machines removes from the problem of city merchandise transportation many uncertainties and expensive casualties with which the employment of horses is constantly attended, the change would seem to be imperative at the earliest possible moment.

Any reasonable speed can be previously arranged for, and any radius of action consistent with working time available for the operation of the vehicle can be supplied with an exactitude with which no other form of vehicle can favorably compare. This regulation or selection of capacity can be determined in advance by the most scientific instruments available in the mechanic arts, and when it is considered that the cost of operation is almost in direct ratio to the work performed and always subsides with cessation of labor it will be seen that the electric should be accorded universal recognition.

During the last fifteen years that the manufacturers have been engaged in pushing the business they have had occasion to know what the real problem is. Business electric wagons have greatly improved, but the point that makes an impression in the history of their development is that as long as ten years ago the power electric wagons had already reached a point which made them more economical than horses for all service within certain limits.

The average cost of bedding and feeding a horse is 55 cents per day. In other words, it costs $33.00 per month simply to feed and bed a carriage team. If this team covers 25 miles per day at a speed of approximately ten miles per hour it is doing more work than the average team can stand. In the electric vehicle man has devised a utility that can do twice the work of the average team, twice as quickly at one-half the cost.

It is estimated that there are 25,000,000 horses in this country, and that 3½ acres are required for raising food for each horse, an area amounting to 87,000,000 acres. Seventy-five per cent of the horses are used in trucking. The replacement of these horses by the electric truck would relieve many thousand square miles of land which could be used for raising food for human consumption. The price of hay and grain has been going upward while the price of electric current has steadily been downward.

A movement is already on foot in the eastern metropolitan cities to restrict the horse from certain congested thoroughfares. With the elimination of the horse and steel tires the expense of street cleaning departments and street repairs would be greatly reduced. The surface of the streets would gradually become smoother and harder, and practically free from dust and flying particles of stable refuse, and the clatter of the horse's feet would be a thing of the past. There is a good reason why municipalities should favor the adoption of the motor truck.

From the standpoint of the user, rents of stable properties, as well as cost of harness and feed, are steadily advancing, and hence he turns instinctively to the electric vehicle manufacturer for relief. The customer observes that the motor truck does not require so much space when at rest or when turning around and is much more easily and quickly handled. He also sees there is a saving in maintenance of tires on an electric as compared with a gasoline vehicle.

While numerous stops and starts are imperative in congested districts, the electric shows the gainer in time, as it has no crank, gear or clutch to manipulate. Then again, the life of the electric is from two or three times that of the gasoline machine, due chiefly to lack of vibration which always attends the operation of a machine containing an engine of the explosion type.

No extra insurance is imposed on electric trucks or the buildings and contents where they are housed, and the electric is admitted to wharfs and freight sheds from which the gasoline trucks are excluded.

It would seem that a campaign among municipalities in behalf of the electric vehicle for police and fire department service offers great possibilities. It would help manufacturers to dispose of their products and would be of advantage to the cities and the underwriters. The charging and operating conditions of the electric offer no barrier to its introduction into fire departments because the capacity of the battery is ample to meet all requirements.

The better a man becomes acquainted with an electric car the more apt he is to consider it simple than before he was well acquainted with it. Those parts which may not seem simple to the purchaser he need not bother with, because experts have thought the matter out for him and have arranged these parts so well that the user need never bother with them.

(The End.)

Electrical Securities

The Duties and Obligations of Public Service, or Utility, Corporations to the Public—Some Explanations, Criticisms and Suggestions—Frank Acceptance of the Principle of Government Control, but Based on the Loyal Support of the People at Large—Publicity and Openminded Square Dealing the Logical Conclusion of the Modern Method—The Reasons for Monopolization, of the People, for the People and by the People.

By "CONTANGO"

In last month's article a good deal was said as to the responsibility of the banker, broker or bond house to the public. After suggesting what should and should not be expected some certain tests for determining the standing of such houses were brought out. This month a somewhat like discussion of the obligations and duties of the large public service corporations of the day, in so far as the people at large are concerned, will be attempted. By the term the "people at large" is meant, not only those who are patrons or buyers of electric current for light or power, or of other public service offered for sale, but also those who are owners and partners of such enterprises by virtue of stock holdings, or who participate in the earnings and are vitally interested in the standing of such properties as holders of the securities in the form of bonds or otherwise.

In the present times customers, owners of shares and holders of securities dovetail into each other. Nearly always a security holder or owner of stock living in the locality his particular company serves is also a customer, though of course hundreds of thousands of customers have nothing to do with shares or securities *except,* and the exception is very important, to the degree the amount of dividends or rate of interest paid affects the scale of prices charged for the particular public service rendered by such corporation.

Now the men who have the initiative and perspicacity to undertake the starting up of these large affairs, and who, therefore, naturally control and manage them, are most wideawake to the value of general public support in carrying on and expanding their enterprises; they know that the more the public is honorably interested the more certain they are of continued success. Indeed, public support both from within and without is the final test of the survival of the fittest. The principle of public control in a general way as to certain matters of policy, public policy it may be called, is, therefore, cheerfully accepted as the right method; that is to say, a judicious governmental control is the best assurance of public confidence. Stability and fair play to all, to those who pay for service and to those who furnish the money to render the service, is thus attained. No more need be said here of this quasi-political side of the question. It is merely touched on as an explanation of the ever-widening tendency, the constant broadening of its scope, characteristic of the public service or utility corporation of the day.

The point to be insisted on is that in proportion as these companies grow and spread so do their duties and obligations to the people at large increase far and near.

Let it be supposed you own shares in such a corporation, one selling, say, electric current to the community. You are naturally anxious to get the best possible return on your money, but you also must recognize that the rate of dividend you receive must be based on fair prices to the customers of your company who supply the business that earns those dividends of yours. You may yourself be a patron or customer, call it how you will. In such case you would be the first probably to object to a high charge for your electric light or the current used for your power. You have also to consider the rate of interest paid on your company's

outstanding bonds or securities owned by other members of the community—you may yourself, indeed, own some of these securities. You are thus confronted with three factors, a reasonable charge for your current, as low as you can get it would please you best; the certainty of your regular income in the form of interest on your bonds; satisfactory dividends on your shares.

Right here, then, is the test of the really great and well organized public utility corporation. It is certain the vast numbers of customers who are neither partners nor bondholders will not stand for excessive rates for the service given them. It is certain that the bonds by which money is raised for extending the business and its operations must earn a fixed rate of interest or nobody will buy them. It is equally certain that the stockholders will expect fair returns on the money invested. The fair and proper adjustment of these three points is the first duty and obligation of those in control of and managing such enterprises.

In some parts of the world a limit is set to the amount per cent allowed to be paid as dividends. Where earnings exceed the fixed charges, that is, interest on bonds and the like, and a certain per cent has been paid on the stock—maybe six per cent or maybe seven or maybe eight—and a certain amount has been set aside for the surplus account, which means to the security holders protection of the property bonded to them, should there come lean years, then the rest of the earnings are applied to reduction of the rate charged the public for the service given. You as a customer buying current thus benefit again in the final outcome.

The people at large allow a centralization or monopolization of a public utility corporation on the grounds of economy—the economic survival of the fittest mode of operation by which the people as a whole are to benefit in the lowering to them of the charge for service. The instant they do not so benefit the reason for the monopoly ceases to be. It then becomes the oppression of the many for the benefit of the comparatively few. Therefore we come back to the matter of fair charges or rates for the current or whatever service is furnished, and these are usually scaled or fixed by a public service commission or the municipalities in which such companies do business; in other words, supposedly by the people themselves through their representatives. Understanding now all these points you will more readily grasp the necessity for knowing the character of the men at the head of such corporations.

Unfair financiers, for example, increase the issue of shares for the purpose of concealing high earnings made. Sometimes they give extra dividends of stock, sometimes merely offer a further lot of shares for public subscription. We do not, however, wish to deal with the evil effects of poor financing. To advance the price of shares may, it is true, interest capital—nay, command it—but after all the final solution must be found in what there is behind this high price. It is better by far to jog along in the usual way and leave the price of your shares and securities to the judgment of the public, than to try and anticipate or regulate it by inside manipulation.

This should demonstrate at once the absolute need for full publicity and open-minded square dealing as to every financial transaction of moment. Last month some reference was made to officials who deal or speculate in the shares of their own company—an absolute destroyer of confidence—also to brokers or bond houses that make different prices to different individuals for bonds, or even shares, where they are not generally dealt with or tested on the public exchanges. The same thing applies to the responsible management of a reputable public service corporation; it is its duty and obligation to protect the public against such impositions; it cannot protect the public, however, against its own demand and therefore the public in a free market, to a degree, makes its own prices.

But the speculative element and the professional speculator must never be lost sight of, although having nothing to do with this suggestion.

Traveling in an elevated railway car the other day the writer heard two postmen discussing the bonds of a very well known public service corporation. They both expressed their liking for these particular bonds and their desire to buy, but considered the price too high and too uncertain, "too much commission charged and the price never the same in any banking house" was the way they expressed it. Probably they exaggerated, for it may be remarked that reputable bond houses do not maintain two prices for their bonds, as do some of the fly-by-night concerns of poor reputation. The policy of the house of standing is one of fair dealing with their customers. They are content, moreover, with a fair and reasonable margin of profit or commission. Where the investor has first investigated a bond house and found that it stands high in the financial community in reputation and conservatism, he need not fear one moment that he may be overcharged. Investors should be intelligent enough to realize this fact. But the bond business is a great big profession today, and like all other big things its rapid expansion has drawn into it some riff-raff and ultra nimble-witted traders, whose moral sense has become overclouded solely by the desire for the profit obtainable and with a minimum of desire to safeguard the investor.

If such people can get five or six or even 20 points above the market price from an investor, they will jump at the chance.

It is best then for those who want to buy to inquire of the officials of the particular corporation if there is the least doubt in their minds, and the latter, if they are "square," efficient and worthy of confidence, will rightly inform and direct the prospective purchaser, for reputable officials most certainly have this duty and obligation to the public, and they know full well that public confidence is their best asset.

This indeed is one of the true tests of public confidence—the belief that the management does not manipulate the prices of its company's shares or securities. Another is the belief that there is property, dollar for dollar, behind the particular corporation's shares and securities. Yet another test for public confidence is the official attitude as to the rates; that is, prices charged for the public service rendered. When a company persistently fights a reasonable reduction in the face of fair dividends on large stock issues, it can no longer expect public support or confidence. It is to get rid of such conditions that the best posted, most progressive and intelligent of the men who control public service corporations would gladly welcome some plan for a "fair and proper" governmental control of such companies. A "fair and proper control" is the right expression, because it does not convey arbitrary or confiscative measures against the legitimate use of great amalgamations of capital in the direction of monopolies practically formed of the people, by the people, for the people. Nor does it mean guarantee of securities issued, or guarantee of the price of shares offered.

To turn to another side of the matter of the duties and obligations of public utility and kindred corporations, there is the daily, hourly, every minute contact with the people in all their varying moods —the divers nationalities, lack of, or superabundance of, education, timidity or aggressiveness, degree of honesty or the reverse—the friction and wear of daily life in fine. It is the duty and obligation to remember through it all that on the good will of each member individually, and of all the members collectively, of the general public depends the real success or lack of it of even the greatest organization, which owes its very existence to public service adequately and acceptably rendered. It is almost unneces-

sary to recall here how in the case of certain well known traction companies, well known most certainly to the readers of these pages, a lack of such obligations and duties produced the most disastrous results. The day of "the public be damned" policy has long since passed away and not even "one of the little ones" can, in the broad sense, be neglected.

There is finally the question of the relations of the public utility corporation with its employés in connection with its finances, its property and its shares and securities, even the degree to which they may be admitted as partners by a distribution to them of something over and above their mere wages. This, with the affair of the wages themselves, employés

A PUMPING BARGE IN THE MISSOURI

insurance and savings schemes and retiring or length of service compensation may be considered in a later article.

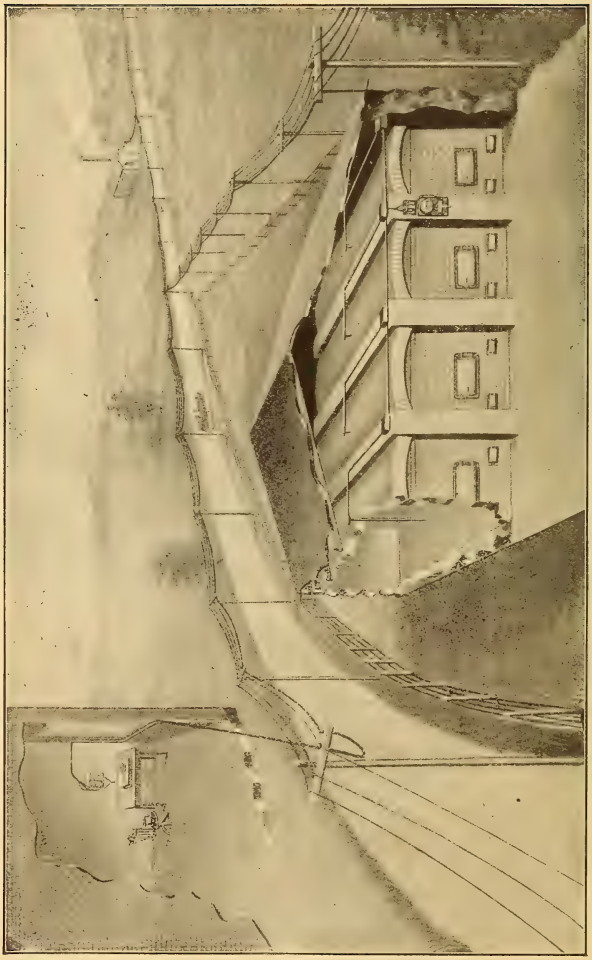
You have then had placed before you the salient points which you should bear in mind, or look up, should you intend buying the shares or securities of any public utility or service corporation. The larger the companies; that is, the more comprehensive and embracing the centralization, the better for your purpose. They are the safest and by the very reason of their widespread public business their general reputation and standing is more readily ascertained. Harmonious relations with local authorities and lack of pronounced political leanings are also of course very pertinent points to be considered. The securities of a company always at war with public officials and authorities, or with anyone, for that matter, are not by any means desirable from the investment standpoint.

(To be continued.)

Pumping Barges on the Missouri

At Williston, North Dakota, two barges fitted with immense pumps operated by electricity are afloat on the Missouri. They are owned by the government and used in irrigating 25,000 acres of bench land along the river. The barges and the manner of supplying them with electricity are both unique.

In order to generate power the government has turned miner. A ten foot lignite coal vein on government land adjacent to Williston is worked and the lignite carried from it to a plant two miles away and there converted into electrical power. The electricity is transmitted from the plant to the barges. It was not feasible on account of the ever shifting shore line of the variable Missouri to place the pumps in buildings on land, so these two barges were devised as a unique substitute and the pumps placed aboard them. In order that the boats may accommodate themselves to changes in the level of the river, they are connected with the bank by pipes fitted with flexible joints. The pumps operated by electricity force the waters of the Missouri up through the barges into these pipes and thence into settling vats on shore.



BATTERY OF FURNACES WITH ELECTRICAL THERMOMETERS READING SIMULTANEOUSLY IN WORKS AND OFFICE

Measuring Temperatures with an Electric Thermometer

There are today many industries in which the precise control and consequently the accurate measurement of temperature is of great importance. For instance, there are many forms of furnace products which must be treated within a certain limited range of temperature. Other materials must be treated in ovens or by live steam or by heated air. An expert workman may, perhaps, by long practice, determine, by looking into a furnace, when the temperature is about right, or he may be able to judge in a general way by the action or appearance of the materials when the working temperature is approximately correct. But this method is at best little more than guesswork. In this day of efficiency and large output, no process can be left to guesswork.

For the measurement of temperatures in industrial processes, the ordinary thermometer is of little or no avail. It is hard to apply and hard to read in the comparatively low temperature work, and for temperatures running far up into the hundreds or even thousands of degrees, obviously out of the question. So what are known as electrical resistance thermometers have been developed, as notably exemplified by the Leeds & Northrup system of temperature measurement.

This system is applicable for measuring any temperature, from the lowest which can be obtained up to 2,200° F. It employs the fundamental principle of electricity that a conductor of electricity presents a resistance to the flow of current in an unvarying ratio to the temperature of the conductor. There are, then, only two elements necessary to the system—a resistance bulb which contains the resistance wire and which is located in the region where the temperature is to be measured, and a temperature indicator which makes visible to the observer the changes in the resistance of the wire which are brought about by the heat.

Without going into technicalities, it may be simply stated that an electric current is passed through a circuit including the little resistance wire and the indicator. As the temperature increases or decreases the resistance of the wire is increased or decreased and less or more current flows through the system, as the case may be. This varying flow of current is recorded by the pointer on the dial of the instrument which is made to read in degrees of temperature. There are varying forms of this indicator instrument, one form which even makes a graphic record on a paper strip of every temperature variation in a given period. The resistance bulb is also constructed in varying forms to suit the particular class of work in hand.

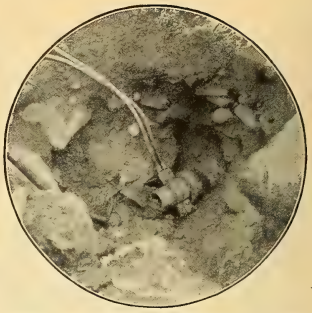
The great advantage of the system lies in the fact that the exact temperature of one or several furnaces may be read from a single instrument, even by a workman who cannot read English; or several instruments may be electrically connected to the same bulb or set of bulbs so as to be read at different points, however far away, as, for instance, in the office in one building and in the works off somewhere else in another building. The illustration on the opposite page is an example. Here there is an indicator at the front of the battery of furnaces. A cable leads from that indicator into the office where another instrument is located and over in the building in the upper right hand corner of the picture still a third instrument is located, all giving simultaneously the exact temperature in any one of the four furnaces indicated. By the movement of four switches, one after another, the four temperatures may be ascertained at a glance.

The Biggest Thawout on Record

By ARTHUR H. MILLER

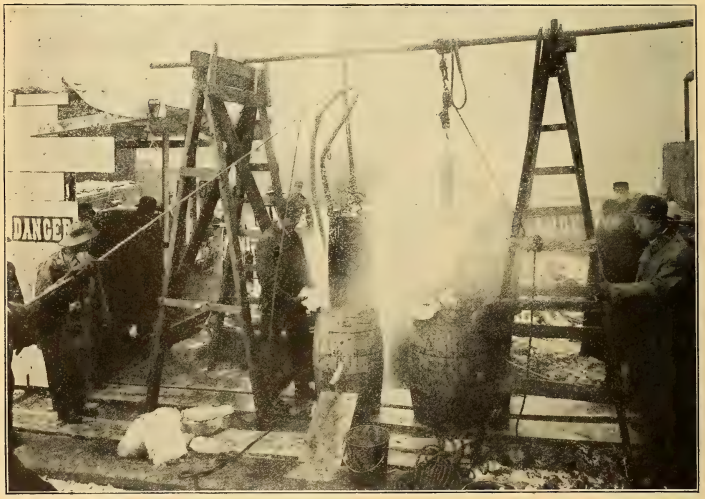
On March 6 the New York Edison Company received word from C. F. Lacombe, chief engineer of the department of water supply, gas and electricity, of New York City, to undertake the startling task of thawing with electric current the six-inch water main under the East River, on which North Brother Island is dependent for its water supply.

For more than a month this pipe had been frozen and the conditions on the island were becoming serious. Although surrounded by water, the inhabitants of North Brother Island were facing the prospects of a water famine. The island is devoted to a number of departments of the City Hospital and so alarmed were the authorities becoming over the situation that orders were issued from the department of health for the removal of a large number of the patients.



METHOD OF ATTACHING THE CABLES TO THE WATER PIPE

The pipe rests on the bed of the river. The fact of the matter is that more ideal conditions for freezing up a pipe could hardly be found. It's just like an ice cream freezer. The water of the river being salt water, will go down as low as 28° F. without freezing, while the

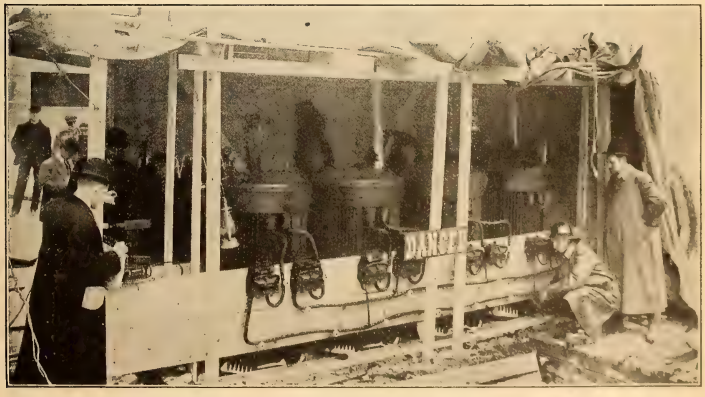


WATER RHEOSTATS FOR CONTROLLING THE CURRENT IN PIPE THAWING

COFFEE AND SANDWICHES FOR THE THAWING CREW

water in the pipe, being fresh, must necessarily freeze at 32°, unless it is kept on the move. First the pipe froze up tight at the North Brother Island end where it comes out on the beach and is exposed at low tide to the zero temperature of the air. When these few lengths froze the water in the rest of the pipe stood still and soon froze solid.

Within just one hour after the New York Edison Company received word from Chief Engineer Lacombe to proceed, the work was under way. W. T. Morrison, the engineer in charge of the Bronx district, took command. First a gang of carpenters put up a shack on the shore of the East River at 141st street, which was turned into a temporary sub-station. A bank of four 100-kilowatt transformers were installed to step the current, which was taken directly from the company's mains, from 2,000 volts down to 200 volts. A water rheostat was also installed. A cable carried the current to the point where the pipe was severed. The pipe was also



A TEMPORARY SUB-STATION WITH FOUR TRANSFORMERS AGGREGATING OVER 500 HORSEPOWER

severed at the North Brother Island end and the current taken off there and returned to the mainland on the company's cables and then put back in the circuit through the pipe again. In this way the immense volume of current flowing through the pipe heated it and finally melted the ice.

The men worked all night on the sixth and at 10:15 a. m. on the seventh the current was turned on. At 11:30 it was increased to 800 amperes and 200 volts. Pumps were installed on North Brother Island and a pressure of 80 pounds maintained in the main. These pumps were operated by electricity. During the evening of the seventh the current was increased to 1,000 amperes. A lamp wagon of the Bronx district was pressed into service as a lunch wagon and sandwiches and hot coffee were served to the gang of men at work both on the mainland and on the island.

The next day was Friday, the eighth, a cloudy day with rain toward night. Another boost was given the current so that it was kept up to an average of 1,300 amperes. The pressure was temporarily taken out of the North Brother Island end of the pipe and the city water pressure applied in the Bronx end. This was without results and the pressure at the island end of the pipe was resumed. Early in the afternoon the hopes of the men were raised. The cause was a considerable amount of steam which came out of the pipe on the Bronx shore. This was not a slight vapor but real steam. It continued to pour out for some time and seemed a sure indication that the ice was melting.

All that night the current was kept up to 1,300 amperes and on Saturday morning, the ninth, it was boosted to 1,500 amperes and 400 volts, the temporary substation being enlarged and two more 100 kilowatt transformers installed. At 11 o'clock on Sunday morning it was put up to 1,600 amperes and two hours later to 1,800 amperes. It was kept to that point until 6 p. m., when on account of the night city load it was dropped back to 1,600 amperes.

On Monday, March 11, the current was again brought up to 1,800 amperes. It was indeed a "Blue Monday," for although the current flowed into the pipe unceasingly, nothing happened of any note. With the coming on of the city load Monday evening the current was again dropped back to 1,600 amperes.

Success came most unexpectedly at 6:20 a.m. on Tuesday, March 12. Without the slightest warning, water started to flow from the mainland end of the pipe. The pumps on North Brother Island which had been working all night keeping up a pressure of 50 pounds in the pipe were forcing the water through. Within a short time the flow of water proved that the pipe was entirely thawed out.

Saved by the Mine Telephone

Two miners, or "shot-firers," to be exact, employed by the Girard Coal Company in a mine at Radley, Kansas, are today more than thankful for the invention of the telephone. The mines of this company have recently all been equipped with mine telephones, and, according to the rules of the coal company, the shot-firers must report to the night engineer by means of the telephone the progress of their work as they go through the mine lighting the shots. This enables the engineer to know where his men are, so that if he does not hear from them at certain intervals, a rescue party is sent down.

One evening after the miners had left, the shot-firers went down as usual to fire the shots which would bring down the coal for removal during the next day. The two men had just entered a refuge hole and one was in the act of ringing the engineer to tell him they had lighted the shots in that particular entry, when an explosion occurred. The force of the explosion was so strong that it blew in the back end of the refuge hole, and the shot-firer did not even get to

talk, but was immediately overcome by the after-damp. His partner, who was with him, was likewise overcome. The night engineer, knowing that this was the station from which they should next report, immediately tried to call them, but was unable to get any response and started the distress whistle. In fifteen minutes after the explosion had occurred a rescue party was in this refuge hole and had the two shot-firers out working upon them and succeeded in resuscitating them. A little later it would undoubtedly have been impossible to revive them.

Kicking That Battery Around

No half completed structure is placed on the market by Mr. Edison on which, after the user has consumed all his available time in attempting to follow long-winded instructions, he suddenly discovers he has completed an autopsy.

When the Edison battery was at last completed to the apparent satisfaction of all concerned, and associates were imploring Mr. Edison to market it, he sketched out the apparatus shown in Fig. 1. This went to the engineering

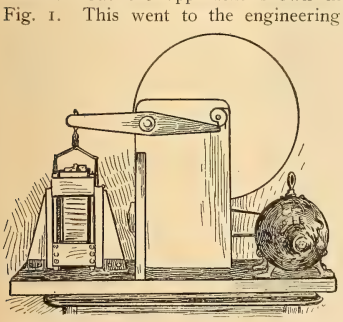


FIG. 1. APPARATUS WHICH LIFTED AND DROPPED ONE CELL 2,000,000 TIMES

and construction departments of the laboratory, and he patiently awaited completion of the machine.

"When six cells, picked at random from several hundred, stand up to tests, itemized below, you may start the foundation for that factory," was written to Mr. Bachmann, the general superintendent of the laboratory. Accompanying were the following tests as laid out:

"1. Mount cell in cage of apparatus.

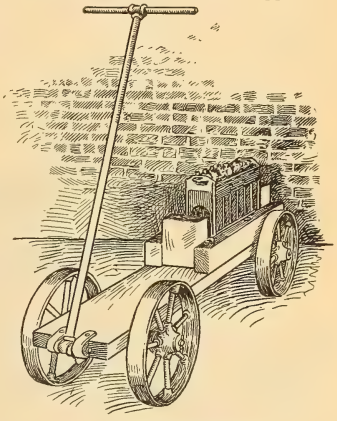


FIG. 2. THE BRICK WALL TEST

No cushioning whatever between the cell and cage. Run the apparatus continuously until the cell has been raised three-quarters of an inch and dropped on a solid block, *two million times.*

"2. There must be no sediment in the bottom of the can after this test, and the cell must have as great electrical capacity as before the test.

"3. Having run through six successive cells satisfactorily, mount them in a six-cell tray, secure tray to a truck longitudinally, and project truck against a brick or stone abutment *five hundred times, at speed of fifteen miles an hour,* at moment of impact.

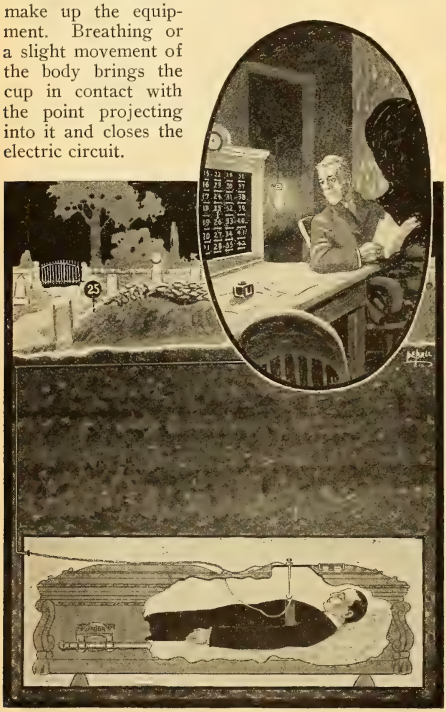
"4. Then place tray of cells laterally across truck, and repeat performance.

"5. Report to me when ready to try 3 and 4. EDISON."

About a year elapsed between the completion of the testing machine and truck and the satisfactory perfection of the battery to withstand the tests.

"What If in the Tomb I Awake?"

Many suggestions have been made and patents issued on schemes to make these words from Shakespeare impossible of realization, and in the plans electricity has not been forgotten. The accompanying picture presents one of these suggestions. A body belt holding a copper cup, an adjustable point, connecting wires, a battery and an ordinary annunciator and bell make up the equipment. Breathing or a slight movement of the body brings the cup in contact with the point projecting into it and closes the electric circuit.



SUGGESTED METHOD OF ARRANGING A GRAVE ALARM

And such suggestions are not to be questioned or ridiculed, for the fear of being buried alive presents itself to every thinking person at some time in life, and to many, among whom may be found well known people, the thought has caused provision to be made to insure against any such horror. The physician to a United States supreme court judge was pledged to cut the throat of the judge in case of death, before permitting burial to take place. Hans Christian Andersen, Wilkie Collins and Lord Lytton are among those who provided against any possibility of being buried alive.

Physicians are well informed as to states into which the body may pass and assume a death like appearance and so continue for days or even weeks and yet the spark of life is still present. Many countries have recognized this, and laws have been made regulating the time that must elapse between death and interment. In Netherlands the body cannot be committed to the grave until 36 hours have elasped. In France the law specifies 24 hours, in Saxony 72 hours and in Austria the body is examined by medical inspectors quite independent of the attending physician and tests are made. Also, should relatives desire it, a post-mortem operation may be made upon the body in the presence of the inspectors and police and the heart pierced through to preclude burial alive.

Precautions like those mentioned might be multiplied, for proof of their necessity is not lacking. In "Premature Burial," by Tebb and Vollum, 381 instances from reliable medical sources are classified as follows: One hundred and forty-nine cases of buried alive, 219 cases of narrow escapes from being buried alive, ten cases of escapes from

dissection alive, one cremated alive and two embalmed alive.

The present method of embalming, of course, sets aside any possibility of life remaining after the process is completed, yet methods may be changed and in accordance with the suggestion offered, electricity may be made to watch over the body whether in a grave or vault for the purpose, until all doubt is dispelled. Then the wiring may be disconnected and the same circuits applied to later graves.

Record Run of the "Lightning Bugs"

The touring automobile that averages 20 miles an hour is going some, as any experienced motorist will tell you. Very few gasoline cars can keep up that speed, and for an electric to come close to it was something unheard of until very recently.

But the fiction that such speed is impossible with electricity for the motive power was thoroughly smashed when not one, but two, electric roadsters covered the 244 miles between Boston and New York in exactly 12 hours and 20 minutes, actual running time.

Mr. W. H. Francis, of the Boston Edison Company, who made the trip in one of the cars, says that the roads between Stamford and New York, the "home-stretch," were in the worst possible condition, and that had they been as good as those covered on the earlier part of the trip, a much better record would undoubtedly have been made.

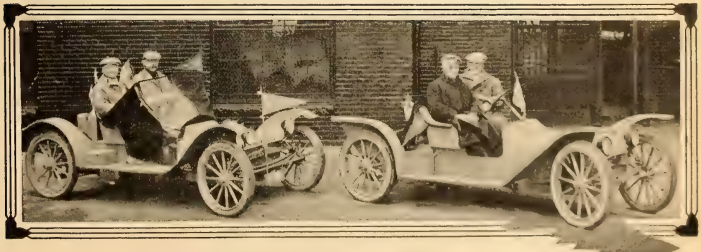
On the strength of this demonstration the Boston Edison Company bought six "Lightning Bugs" like the ones that made the run, for use in its trouble department.

Euphonious Chemistry

Something over a year ago, Mr. Edison asked one of his lieutenants to take charge of a very exhaustive experiment in chemistry. Now, if there is one subject of which that man knows nothing at all, *Chemistry* ranks No. 1. He protested his ignorance, supplemented by predictions of delay and expense, because of it. It had no effect. Mr. Edison smiled good naturedly and said:

"That's just the reason why I want you to undertake this. If you were a chemist, you would not try a lot of things I know you *will* try, because you would conclude ahead of time that they would not work. Now, if present *knowledge* of chemistry would deduce this result, it would have been accomplished long since. It hasn't. Therefore, we have 8,000 bottles of chemicals, I don't care how long it takes, and will pay the bills. So it is up to you."

Our friend undertook that task very much as would a novice pick a horse to win a race—by the attractiveness of the *name*. Wonderful to relate, a combination of a few chemicals having the most euphonious names accomplished the result.



THE SMALL ELECTRIC AUTOS—KNOWN AS THE LIGHTNING BUGS

Dime in the Slot and a Photo in One Minute

In the space of one minute this machine will take your photograph, develop, tone, wash and deliver it—a clear, clean, well defined portrait. If, for any reason, the plates are exhausted, for the machine holds but 100 plates at a time, the Auto-Foto hands you back your dime without a single kick.

A small electric motor sets the machinery in motion when the dime is inserted

DIME-IN-THE-SLOT PHOTO MACHINE

and the lever is pushed. An electric lamp attached to the top of the cabinet furnishes the necessary light; this is automatically turned off and on, so that daylight or darkness is of no importance in the operation of the machine. It meets all conditions.

The "works" are incased in a steel cabinet. In front of the cabinet is a stool where the subject sits. The stool has a circular or oval shaped back serving as a background for the picture. As the stool is adjustable, the reflection of the subject's face is visible in a small mirror on the front of the cabinet; this acts as a finder. The sitter places a dime in the slot, pushes a lever and in three seconds a bell rings announcing that the picture has been taken. In 57 seconds more the Auto-Foto delivers the picture completed, and framed in a round brass frame.

The secret of the machine lies in the *single* chemical solution required to make the picture, which was discovered by Henry Doyle, a New York newspaper man.

Hotel That Is Electrically Charged

A curious freak of electricity has come to light in the Jefferson Hotel, a half million dollar structure recently erected in Peoria. Every metal column and pillar on the mezzanine or second floor is apparently heavily charged with electricity.

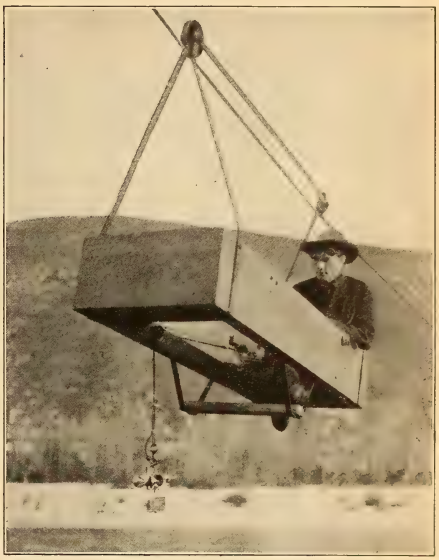
The floor is constructed with numerous heavy metal columns, pillars and railings that wind around the balconies, and none of them seem to have escaped the electrification. The curious phenomenon was first noticed when a young woman, a guest at the opening reception of the hotel, leaned against one of the metal columns, and was shocked so strongly that she was compelled to refrain from dancing for several numbers. Every time a hand is placed against a pillar, or when the railing is touched in descending the stairs, a noticeable shock results.

An explanation that is accepted by the hotel management is that the electricity is caused by the carpets on the floor. The friction caused by walking over them, it is claimed, causes the body to be charged with static electricity. Then when a hand is placed against the metal pillar, it is claimed that a circuit is formed and a shock is the result.

Measuring the Flow of Large Streams

The very first thing to be determined in the preliminary plans for building a water power electric plant is the flow of the stream in cubic feet per minute or per second. For the volume of water flowing is one factor which, together with the speed, determines the power which may be developed. In the case of plants already established, careful investigation in this manner, of the power available, will in many cases show that all the power is not being used and that more turbines and generators may be added, increasing the earnings of the plant.

For measuring the velocity of small streams the method which was outlined in the April issue of this magazine is satisfactory; that is, by timing the progress of a float down the stream. But in the measurement of larger rivers there are many elements such as undercurrents, eddies, whirls, rapid and slow portions of the stream, etc., which enter to make the method cumbersome and inaccurate.



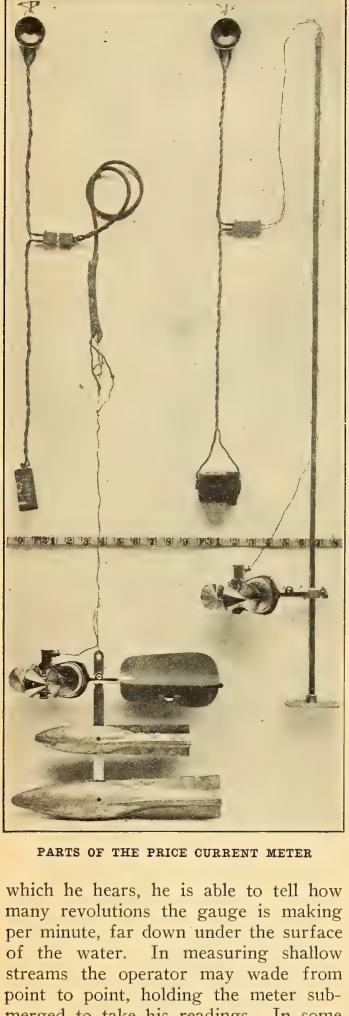
Photographs by Courtesy of Stone & Webster.

OPERATING THE CURRENT METER FROM A TRAVELING CAGE

In order to gather accurate records of the velocity of all portions of the stream, various types of current meters are employed. One type is known as the Price meter, extensively experimented with and improved by the United States Geological Survey. It is highly interesting to watch the measurements being made with this sensitive bit of mechanism, half electrical, which swims in the stream like a minnow.

The parts of the instrument are plainly shown in one of the illustrations. A series of vanes, similar to the tail of a fish, keep the head of the device pointed up stream and a weight permits its suspension at any depth. The moving part comprises a little vertical revolving shaft carrying four horizontal arms with cups on the ends, similar to a wind gauge. The rapidity with which the cups revolve is proportional to the velocity of the water in which they are suspended. In addition, there is a device for registering the number of revolutions. The instrument is calibrated so that the operator knows that a certain number of revolutions, in a minute, say, represent a flow of a definite number of feet per minute or per second.

In some forms of the instrument a telephone attachment is employed, with a watch case receiver, which the operator holds to his ear. Then, by the clicks



PARTS OF THE PRICE CURRENT METER

which he hears, he is able to tell how many revolutions the gauge is making per minute, far down under the surface of the water. In measuring shallow streams the operator may wade from point to point, holding the meter submerged to take his readings. In some streams he may work from a bridge. In other cases, however, it is necessary to drag him across the river on a suspended cableway.

A Remarkable Case of Electrolysis

During alterations in a poultry commission building in South Water Street, Chicago, it was found necessary to remove a brick partition wall from the basement under the sidewalk. On the wall was fastened a 50 ampere, double pole knife switch enclosed in an asbestos lined wooden box.

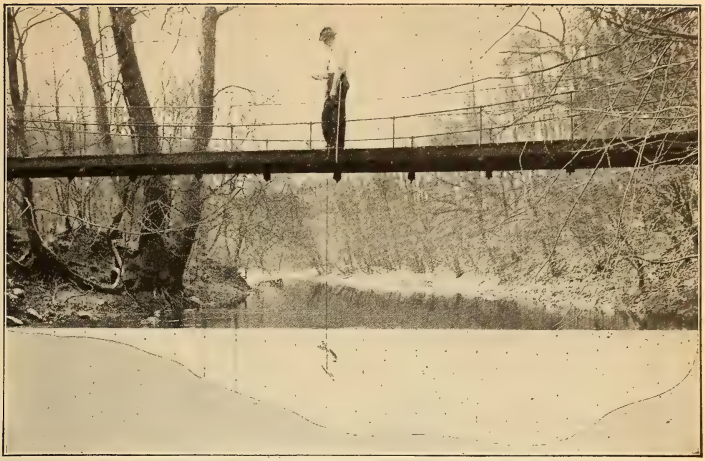
The switch box and its lining were found to be wet, because the basement was so damp. The switch itself was found to be almost entirely loose from the wooden box, as the screws which had held the switch were pushed out of the rotten wood by a crystalline mass which covered the entire back of the switch.

When the switch was separated from the crystalline mass it was observed that a shiny liquid filled a hole in the back of the switch. This liquid resembled mercury at first, but it soon began to change its appearance, a coating of white deposit changing its bright, shiny surface to a dull gray.

When the point of a pencil was dipped into the liquid, a small flash would spurt up about an inch or so. Both the liquid and the crystalline mass were fast changing their form, the first to a white substance and the second to a shiny mass.

Desiring to know what kind of substance the liquid was, it and the crystalline material were taken to the laboratories of the Commonwealth Edison Company, where, through the courtesy of Mr. McClure, the head chemist, the liquid was analyzed and found to be metallic soda or sodium. Many globules of sodium were found inside the crystalline mass, where they had been protected from the oxidizing effect of the air.

The question was, how the sodium happened to be in such a peculiar place, but as chloride of sodium is common salt a solution of the problem was quite



METHOD OF USING THE CURRENT METER FROM A BRIDGE

easy. Much salt had been used above and in the vicinity of the brick wall, consequently the wall and the wooden switch-box, with its asbestos lining, were thoroughly impregnated with salt.

Current had leaked, from a screw in the hole in the back of the switch, to the ground through the moist asbestos, wooden box and brick wall.

This current was sufficient to break up the salt into its elements by electrolysis.

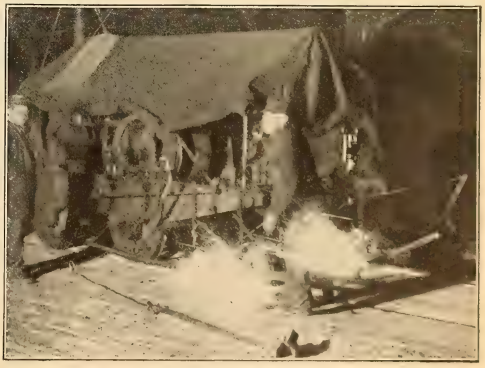
HENRY L. TRANSTROM.

Linguist Operators

In Egypt the telephone operators are men. They must be linguists too, for before a man can find employment as a telephone operator he must speak English, French, Italian, Greek, and Arabic, for the Egyptian telephone has to serve all these different tribes of mankind.

Grinding Down the Rails

After street car rails have been welded end to end, the rough, uneven joints must be ground down perfectly smooth. This is done by an electric grinding machine, which works day and night. Current for the operation of the motor, carried on a small car, is obtained from



RAIL GRINDING AT NIGHT

the trolley wire. The motor is then belted to the grinding wheels which are dragged behind the car. These grinders are mounted on a carriage. The whole machine works automatically, the anchor and rope in the foreground operating to reverse the motor and draw the emery wheels back and forth over the joints until the surfaces are perfectly smooth. The grinder is shaped so as to finish off the inner as well as the top side of the rail at the same operation.

The Gruenwald Grotto

This is a picture of the famous "Grotto" of the Gruenwald Hotel, New Orleans, La. Seated at a table in this odd dining room one can spend hours in studying the grotesque forms worked into the walls, pillars and ceilings. One of the most striking features, however, is the method of illumination. Hidden among the overhanging stalactites and in wall recesses are hundreds of electric lamps which not only light the place but produce queer light and shadow effects upon the cave-like interior. And this wierdness is further heightened by using incandescent lamps of a great variety of colors.

THE GRUENWALD GROTTO

"Freezing Out" the Resistance

That the resistance of the common metals (including that of mercury, a metal liquid at our ordinary temperatures) increases somewhat as they are heated has long been known. But what will happen if the temperature is decreased way below the normal, say, close to the absolute zero of the scientists? Several years ago Prof. H. Kammerlingh-Onnes, of the University of Leyden, found that when pure gold was lowered in temperature to —262° (or about 440° below zero, Fahrenheit) its resistance was only 1/400 of what it was at 30° F., while that of mercury fell to only the 1/120 part.

Recently the same investigator has succeeded in liquefying the rare gas helium and by doing so has been able to reach temperatures within six degrees of the absolute zero. There he found that the resistance of pure quicksilver was only a millionth part of what it was at 32° Fahrenheit. In other words, the resistance of metals seems to be a quality depending largely on their temperature and one which may be said to be practically "frozen out" when this temperature is greatly lowered.

Metropolitan Mining by Electricity

By GEORGE H. HALL

Any reference to mining operations ordinarily presents to the mind the rough surroundings of the open country, the big steam driven head-hoist, the flickering of hundreds of little lamps in the caps of grimy miners, the continuous rattle of steam drills and the throb of steam pumps. The operations now in progress through, or rather under, the heart of our greatest city are of particular interest on account of the absence of these usual accompaniments. Yet they may certainly be considered as mining operations on a most elaborate scale.

DOWN 200 TO 750 FEET BELOW THESE HEAD HOISTS THE TUNNEL "MINERS" ARE WORKING

This work constitutes the delivery end of the largest municipal water system that has ever been undertaken. The system starts in the Catskill Mountains, about a hundred miles from New York City, where a number of enormous reservoirs furnish the water supply that will be brought to the city through a huge aqueduct having a length of 92 miles. Fifty-five miles of this aqueduct will be built by the "cut and cover" method of construction, six miles will be of steel pipes, while the remaining 31 miles will be tunneled through the solid rock. One feature which is in itself a masterpiece of engineering, is the passage of this tunnel under the Hudson at a depth of 1,100 feet below the surface of the river.

While the work in the mountains, and through a large part of the course toward the city, can be carried on by the usual tunneling methods, conducting such work through the center of a great city presents unusual conditions that call for a wide departure from the ordinary ways and means of tunnel construction. Down through the entire length of Manhattan this tunnel is now working its way, but so quietly and unobtrusively is it proceeding as to attract but little attention from the general public. Occasionally one may hear the dull boom of a heavy blast somewhere down in the earth below, but, except for the sight

of frequent hoisting and dumping stations, no other signs of this stupendous work are visible.

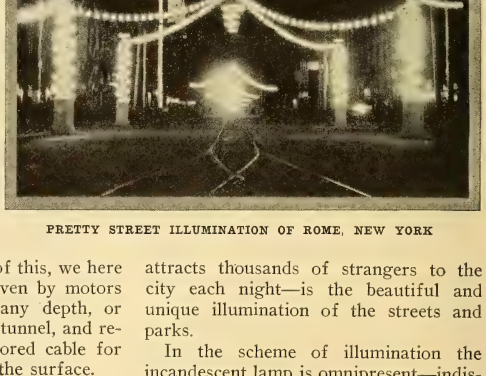
The shafts are nearly all located in public parks or squares where a head-hoist and a few temporary buildings are enclosed by a high board fence, and from these centers the dump carts are busy at all times carrying away the rocks and dirt which constitute the only product of these peculiar mines. These shafts are sunk straight down to a depth varying from 200 to 750 feet, and from the bottom the tunnel is driven in both directions, north and south, to meet the tunnels from the shafts next in line.

A most interesting feature of this great work is the extent to which electricity is employed for the operation of all of the machinery that is used. One of the most serious obstacles to the construction of such a deep tunnel is the presence of water, requiring constant pumping to prevent flooding. In ordinary mining operations, steam driven sinking pumps are employed, requiring long runs of steam and exhaust pipes, which increase in length as the shaft deepens, and involve considerable losses in condensation, as well as the presence of clouds of exhaust steam which would be particularly objectionable in the city. Instead of this, we here find all of the pumps driven by motors which may be sunk to any depth, or carried to any part of the tunnel, and require only a flexible armored cable for bringing the power from the surface.

The drills are operated by compressed air instead of steam, and the air for this purpose is supplied from motor driven compressors. All of the hoisting is done with huge, electrically driven winding drums, operating night and day, but so quietly as to cause no disturbance to the thousands of people living in the vicinity of the shafts. The lighting is, of course, done by electricity, thereby dispensing with the more picturesque but less serviceable miners' lamps.

Illuminating a Carnival

A novel method of using electric light for the purpose of municipal advertisement has been adopted by the Romohawks, of Rome, N. Y. The Romohawks, be it understood, is an organization of business men formed for the express purpose of "boosting" the city. The first week in September of each year is set aside for the Romohawk Carnival. The city is gayly decorated and there are many daylight diversions, including the Oneida County Fair. But the greatest feature of the carnival—that which attracts thousands of strangers to the city each night—is the beautiful and unique illumination of the streets and parks.



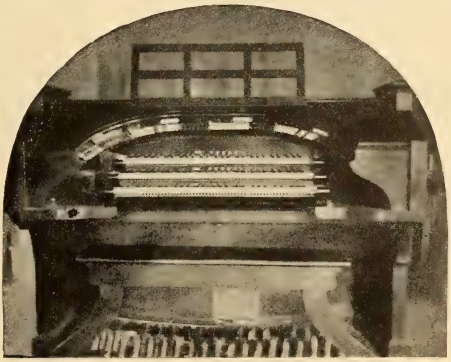
PRETTY STREET ILLUMINATION OF ROME, NEW YORK

In the scheme of illumination the incandescent lamp is omnipresent—indispensable. Strings of glowing bulbs are looped across all the principal streets at frequent intervals. On the main business thoroughfare tall white pillars, each encircled with a spiral of small lights, are placed along the curbs and linked together with chains of larger lamps.

The Unit Orchestra

By MAURICE ROSENFELD

More than 30 years ago in Atlantic Garden, on the Bowery in New York City, below Canal Street, there was a sort of elephantine music box, which could be wound up like a clock, and would then play with more or less orchestral effect—there were drums, cymbals, castanets and snare drums within the mechanism—certain musical pieces according to the perforated rolls which the instruments contained. The Orchestrion, I think it was called, was used during the midday, when the regular orchestra was off duty, and I watched its mysterious workings many times, and listened to its mechanical music-making with considerable wonder. That it could not be regulated by anyone after it was wound up, that no tonal nuances could be produced, and that it was in a way simply a machine, ingenious enough, occasioned no further thought.



Now, after 30 years, we come to the latest invention of Robert Hope-Jones, a celebrated English organ builder and we have an instrument which he styles the "Unit Orchestra."

Mr. Hope-Jones, known at first as an English expert electrician for a telephone company, was always interested in music, and finally diverted his electrical knowledge for the purpose of perfecting an instrument which would have all the tonal colors of the symphony orchestra, but which by electrical contrivances and motive power could be played by one musician at a keyboard from whence all the different orchestral combinations could be brought into play.

He was present last summer at a meeting of the National Association of Theatrical Producing Managers in New York City and one of his chief backers in his invention is William A. Brady, president of that association, who has prophesied that this new "Unit Orchestra" will shortly displace the usual orchestra in theaters.

This instrument is on the order of a pipe-organ with the usual pipes, but supplemented with a great many more contrivances for tonal colors than the regular pipe organ which we know, and with sets of reeds, flute and even a sort of string-like sounding stops and pipes, which resemble the violin family of tones. Besides, there are many percussion stops such as the various drums, cymbals and castanets; there are also the celeste, harp, xylophone and bells. The advantage of the Unit Orchestra over any other pipe organ or mechanical player is that it brings forth really orchestral effects and can be played like a solo instrument with the manifold colors and combinations of a symphony orchestra.

The performer is not restricted to certain records or rolls in the choice of his

selections; he need not wait for rolls of the pieces he wishes to play, but he can take the score of any composition, no matter how difficult or intricate, and reproduce it with all its shadings on the instrument. The artist manipulating the instrument retains his individuality of interpretation, he can exercise his musical taste and style, he is only limited by the existing literature of all kinds of music, whether symphonic, choral, operatic, vocal or instrumental.

A theater which employs but a small orchestra of not more than ten men and a leader must figure on a yearly expense for music, which amounts to thousands of dollars per annum. Taking a minimum amount, say, of ten men, would mean an outlay of $250 per week and for only a short season of 30 weeks, it would sum up to $7,500 during the year. Even if the initial price of the Unit Orchestra should amount to nearly that, in two years, and an artist of the first rank be engaged to play it, there would undoubtedly be a balance to the credit side of the Unit Orchestra.

An organ of the approximate dimensions of the Unit Orchestra has been in use for several years at Ocean Grove, N. J., during the summer chautauquas held under the auspices of the National Association of Organists and Mr. Clarence Reynolds, a friend of Mr. Hope-Jones, has served as official organist for the association. Here both Madame Schumann-Heink and Madame Lillian Nordica have sung to the accompaniment of this organ and have expressed themselves in highly commendatory fashion concerning its practical utility for their purposes.

It would undoubtedly have a strong tendency to improve the standard of the music heard in hotels and in the theaters during the entre acts, and while the larger artistic symphony orchestras would not be affected in their higher musical spheres, the general musical taste would receive a decided uplift through the installation of the Unit Orchestra in the smaller theaters and in other places where music is made one of the features of entertainment.

There is also a similar instrument installed in the Statler Hotel in Buffalo, N. Y., where the pipes are placed in one of the hotel rooms on the fourth floor, while the keyboards, there are two of them, are respectively in the main dining room and in the gentlemen's grill room, either of which can be played with equal facility. The tone is "shot down from the fourth floor by a system of deflectors," so Mr. C. Gordon Wedertz tells me. Mr. Wedertz is organist and choirmaster at St. Bartholomew's church in Englewood, Chicago, and has made an exhaustive study of the instrument.

Mr. Wedertz has had many conversations with Mr. Hope-Jones concerning his inventions and has studied the Unit Orchestra in Buffalo exhaustively. He has trained boys' choirs for a number of years, and also drilled the mixed chorus which is employed behind the scenes at the performances of Wagner's musical drama, "Parsifal," when it was given in Chicago two successive years at the Auditorium by the Metropolitan Grand Opera Company, under Mr. Dippel's management.

Concerning the Unit Orchestra, Mr. Wedertz says: "It is operated both electrically and pneumatically, the process being in no wise more intricate or complicated than in the usual organs."

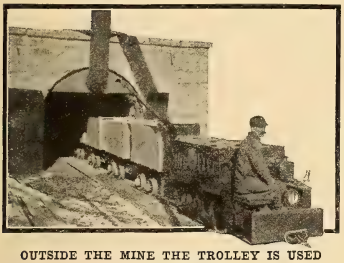
The establishment of a Unit Orchestra in the Cort Theater in Chicago has added another test of its efficiency, and this opens up a new field for the musician. That it will take a skilled artist to manipulate it is true, but it will also carry with it a remuneration commensurate with the artistic ability of the performer.

It is the intention, I believe, to open a school for the instruction of musicians to learn the art of playing the Unit Orchestra, and its superiority for the purposes mentioned above, over the small and indifferently organized hotel or theater orchestras, will soon make it one of the most popular musical instruments.

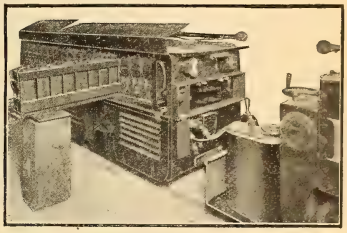
Locomotive That Hauls Its Own Power

It has always been considerable of a problem to get the ore out of the mine safely and cheaply. At first it was loaded into little cars and pushed out by huskies with more muscle than brains. Small mules or burros were pressed into service and did well within their limitations. The steam locomotive was tried, but it used up too much of the precious air. The compressed air locomotive brought in air, but not enough to keep itself going very long, let alone doing much work. It remained for electricity to solve the problem.

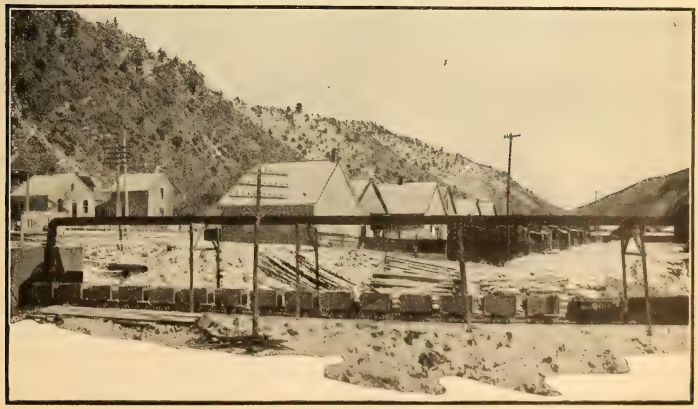
In some mines a trolley locomotive similar to the ordinary street car does the hauling. In others, where there is little room overhead, the trolley wire was too dangerous for the miners, or the sparks that flew when the trolley pole slipped off were likely to ignite the explosive gases that accumulated. Hence came the storage battery locomotive. The one shown in the photograph is



OUTSIDE THE MINE THE TROLLEY IS USED



BATTERY TENDER WITH BATTERIES CHARGING



THE ELECTRIC LOCOMOTIVE SOLVES THE MINE HAULAGE PROBLEM

remarkable in that the battery is carried on a separate tender and as the storage battery is the source of power it may be said that this locomotive hauls its own power.

The battery consists of 208 of the latest Edison nickel-steel cells, which seem to stand the severe banging they get when the chauffeur on this locomotive undertakes to start a string of loaded ore cars in motion by running into them at top speed.

When the locomotive is outside the it sets the tender on a sidetrack for charging and runs from an overhead trolley.

SAWING THROUGH STEEL

An unusual sight to the layman but a familiar one to workers in a steel mill is the cutting in two of heavy pieces of steel. The picture shows a 30 horsepower motor turning a saw 45 inches in diameter at a speed of 1,700 revolutions per minute as it rapidly eats its way through an 80 pound steel rail, throwing off showers of hot iron sparks. The saw is covered by a strong metal hood to keep the particles of iron saw-

SAWING THROUGH STEEL

dust from flying about. The cover also confines water which is directed under pressure upon the rail where the cutting is being done to keep the rail partially cool.

Telephone Features at a Masked Ball

A novel circulating telephone exchange operator was a feature of a masked ball recently given in Braddock, Pa. The young woman was equipped with a breast transmitter and head receiver, which

CIRCULATING TELEPHONE AT A MASKED BALL

were connected in series and terminated in a cord and two-conductor plug. She also carried in her hand, for the use of the other dancers, a Dean bull neck type common battery desk set which also terminated in a two-conductor cord and plug. This type of desk set was used because of its lightness. A line was run into the hall and terminated in a strip of ten jacks. These jacks were multiplied so that, no matter which one you put the plug into you would get the operator.

The equipment was furnished and installed by the Pittsburgh & Allegheny Telephone Company. The participants in the affair were at first unconscious of the fact that actual telephone service would be given. When the discovery was made dancers throughout the ball room were enabled to talk from the floor to friends in any part of the city—this service being free and unlimited.

A German Precaution

An investigation was recently made in Germany to determine whether any accidents had ever been caused in gas works by the ignition of gas with sparks from telephone instruments. No such accident had ever been reported, although it was found by experimenting that gas could be ignited in this way if it were projected upon the instruments while they were in operation. After this test it was decided that the use of telephones in gas works would be permitted, provided the instruments were inclosed in a guard of fine wire gauze.

Religion Advertising

Salvation is free, but it is certainly costing a lot of money in New York City during the activities of the Men and Religion Forward Movement. This may be a paradox, but to invite men to visit the churches of New York, and to extend this invitation by means of electric signs along Broadway, is expensive.

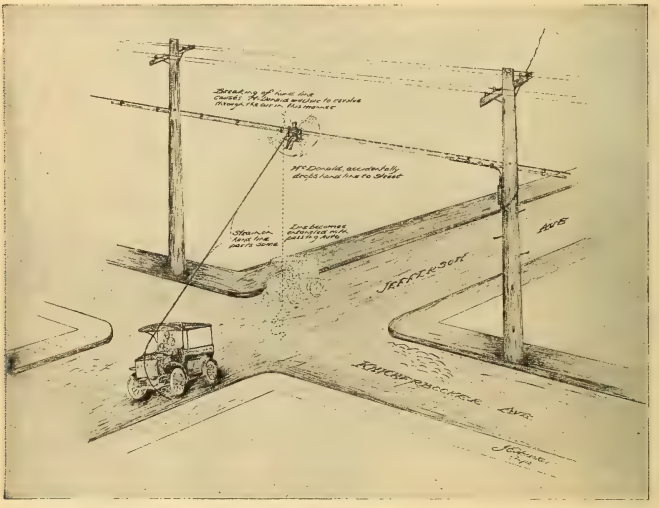
At Twenty-third Street and Broadway, the beginning of the "Great White Way," is placed a sign with letters 13½ feet high, reading:

"Welcome for Everybody in the Churches of New York. Religion for Men and Men for Religion."

This sign, it is stated by those in charge of the Movement, is but the beginning of a campaign of church advertising.

Looping-the-Loop

A peculiar accident happened to lineman Jas. McDonald, while reclipping an aerial cable at Jefferson and Knickerbocker Avenues, Brooklyn. McDonald's hand line having fallen to the street, a passing automobile became entangled therein, and while the rope broke from the strain, McDonald was caused to make two complete revolutions of the strand and cable. Apparently no damage was done either to machine or man.



By Courtesy of the Telephone Review.

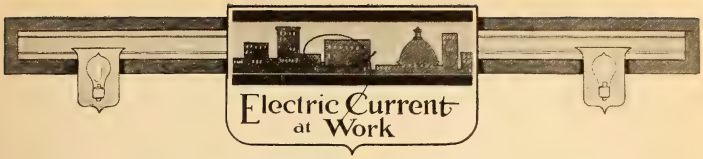
SHOWING HOW THE LINEMAN SWUNG THROUGH THE AIR WHEN HIS HAND LINE WAS PICKED UP BY AN AUTOMOBILE. AFTER REGAINING HIS BALANCE HE COOLLY RESUMED WORK

A Railroad Telegraph School

In order to train telegraph operators, the Pennsylvania Railroad has been maintaining a school of telegraphy at Bedford, Pa. The school is equipped with the most modern appliances, while the library is well stocked with books on electricity. In addition to being taught telegraphy the students are instructed in the use of the telephone in railroad work, and are taught to keep the station accounts. A miniature railroad is used to give practical demonstrations in train operation. It takes from six to eight months to complete the course, after which graduates of the school are given employment on the Pennsylvania Railroad.

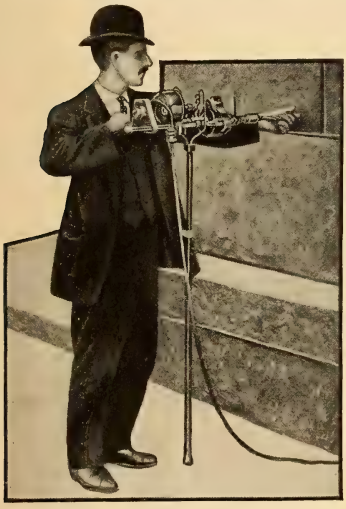
Pitchblende Mining

It is announced that the Austrian government will shortly purchase the pitchblende mines of Joachimstal at a cost of nearly $500,000. The mines are able to produce five grams of radium annually, which at the current value of $90 a milligram means a lot of money for one gram.



Reciprocating Electric Drill

This electric drill is eating its way into solid stone, impelled by 800 blows in a minute. The little motor uses up only ⅛ horsepower of electric energy.

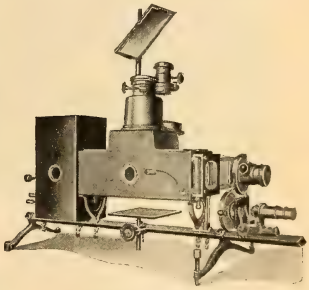


WORKING WITH THE RECIPROCATING DRILL

The mechanical principle is the converting of rapid rotary motion, supplied by the motor, into reciprocating motion, by means of a circular cam, a ball bearing, a floating ring and a spring, which constitute the basic principle of the patent. This machine is suitable for concrete, tile, stone or brick drilling. As the drill point strikes the stone, under the terrific bombardment of blows, it is slowly revolved by hand or by an automatic arrangement.

Four Methods of Picture Projection

The Universal projectoscope combines in one piece of apparatus four methods of picture projection. The direct projection of a picture upon a screen is accomplished by the use of a glass slide upon which the picture is made and through which the rays from the arc lamp pass. In opaque projection, pictures, cards, or drawings are placed on the

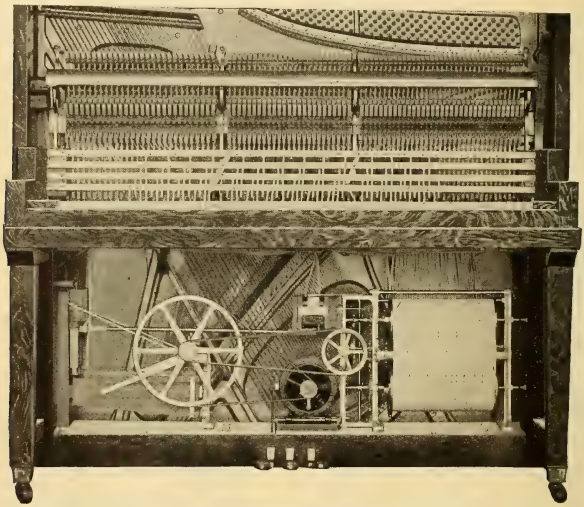


PROJECTOSCOPE

table shown under the middle of the machine and, by light thrown upon them and reflected by a mirror, the screen receives the picture. In each case lenses are used to concentrate and direct the light to the screen. A third interesting feature of this lantern is the device for producing pictures from microscope slides by a slight adjustment of lenses, and a fourth advantage is in being able by the mirror to project pictures in their original colors upon the ceiling. This last feature can be made use of by decorators.

Coin Operated Piano

The "Ariston" is a piano. But the word "piano" does not begin to convey an idea of all that the instrument will accomplish. By pushing in a little lever the music changes instantly to that of an orchestra with drum, cymbals, wood winds and all.



THE ARISTON COIN OPERATED PIANO

The mechanism, including the bellows and piano movement, is operated by a small motor as shown in the cut. The music is produced pneumatically by means of a perforated roll containing 20 compositions. From one to 20 nickels may be deposited in the coin slot and the piano continues to play one tune after another automatically as long as the money lasts. When the twentieth coin is used the music roll is automatically rewound and stops in position for the first tune.

This instrument is intended for public places such as cafés, hotels, etc.

Current Converter for Private Garages

Battery charging must be accomplished by direct current; that is, current which flows continuously in one direction instead of reversing its direction of flow many times per second as in the case of alternating current. Since the current most commonly used in light and power circuits is alternating, a converter must be used to change it to direct for charging batteries.

One way of doing this is to use a converter as shown in the illustration. This is a small machine resembling a motor, but it has two windings on its armature. One is the motor winding, which is fed from the alternating current circuit and causes the armature to revolve. The other winding is the same as that of a direct current dynamo, and it supplies direct current to the battery charging circuit through a commutator.

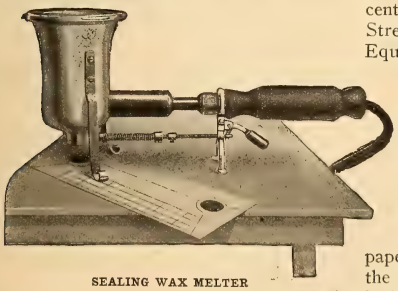
CURRENT CONVERTER IN PRIVATE GARAGE

In fact, we have a motor and a dynamo in one machine.

The advantage of this unit lies in the fact that, in addition to possessing the efficiency and reliability of the large motor-generators used in large charging stations, it is of a size and capacity suitable for use in private garages.

Sealing Wax Melter

The old-fashioned way of placing sealing wax upon letters and packages; that is, by holding a stick of wax in one hand and a match or alcohol lamp in the other, has been brought up to date by the electric wax melter. A metal bowl for the wax with a heating unit in the bottom,

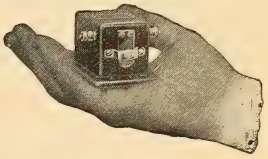


SEALING WAX MELTER

legs for setting on the table and a cord and plug for ready attachment to the lighting circuit, complete the device except for the most important feature. This consists of a small lever handle convenient to the main handle by the pressing of which the bottom of the wax pot is opened to allow the amount of hot wax required to run out.

Baby Spark Coil

This is the smallest stock spark coil in the world. The coil itself is 2⅜ inches long, 1½ inches wide and 1½ inches



BABY SPARK COIL

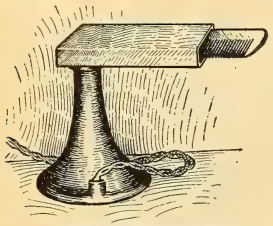
high, and is being used regularly by a well known manufacturer of miniature gas engines. While this coil is small enough to be used as a paper weight, it is a perfect working model and is unusually efficient for its size. It is designed to be operated in connection with three ordinary dry batteries.

Laundry in a Bank Vault

A ten days' job of ironing was recently completed in the vault of a Wall Street bank because of the fire in the Equitable Building, New York City. Pieces of paper, 3,000 in number, representing more than $3,000,000 were taken from sub-cellar vaults of the burned building. The papers were water soaked almost to a pulp. Blotting paper was resorted to in an effort to remove the water but without success. Electric fans were then tried, the notes and papers being carefully hung on lines in the vault. When the air from the fans had carried away nearly all of the moisture a half dozen electric pressing irons completed the work, each paper being ironed out on an ordinary board. Of the 3,000 pieces not one was left in bad condition.

Heating Combs Electrically

As a cheap substitute for an electric hair drier, a German firm is putting out a comb warmer into which a flat comb

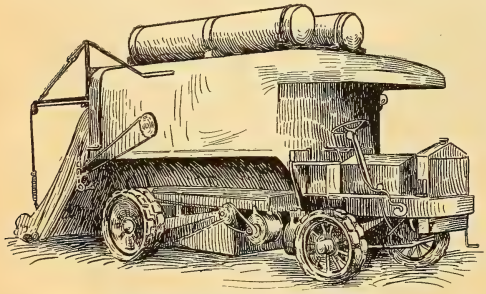


ELECTRIC COMB HEATER

can be slipped. When thus warmed, the comb not only helps to dry the hair if the latter is wet, but also avoids the friction sparks and the crackling which are so objectionable in cold weather.

Gasoline-Electric Street Sweeper

There are four of these machines in successful operation in New York and eight others will be sent to Boston shortly. The prime mover is a four cylinder gasoline engine which drives, by a silent chain, two dynamos which furnish the current to electric motors performing the various operations. The motors are an advantage in this case, over direct drive by the engine, owing to the simplicity of application and ease of control.

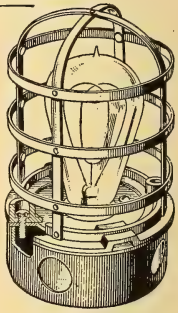


GASOLINE-ELECTRIC STREET SWEEPER

A revolving brush, coming in contact with the street surface, brushes the dirt onto a conveyor belt operating in a steel chute. The dirt is carried up into a large tank, from whence it can be dumped from the bottom at suitable intervals.

In order to prevent dust from being stirred up by the broom, an exhaust fan, driven by a small motor, is used; the set being placed in a small compartment at the forward end of the body and provided with a suitable screen to prevent the escape of dust.

Locking Up Lamps to Prevent Theft



A LOCKED LAMP CAGE

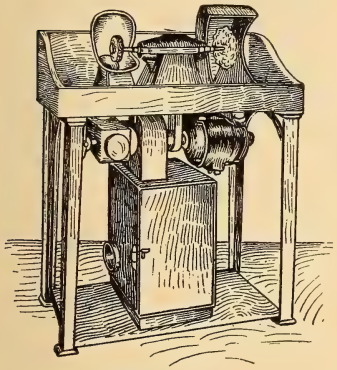
There is a growing demand for a device to prevent the theft of lamps, and at the same time to prevent the overloading of circuits, as in theater dressing rooms, by plugging too large a number of laundry irons, curling irons, etc., into the lamp sockets. The latest method is shown in the cut. A base fitting over the outlet carries a strong metal cage which is locked over the lamp. Unauthorized persons cannot make way with the lamp or insert another current consuming device.

A motion picture theater has been fitted up in the Royal Palace at Bangkok. The exhibitions are, as a rule, intended only for the royal family, although at certain times the general public is admitted to the theater.

Dust Collector on Polishing Machines

More attention is being given to providing safeguards for workmen in shops and factories where dust particles are thrown into the air by grinding, polishing and buffing machines.

The electric motor as shown in the illustration affords a means of operating



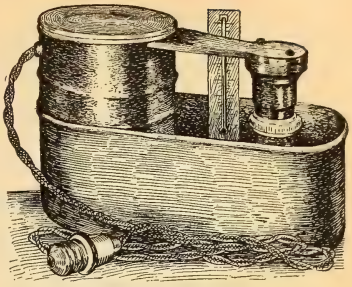
DUST COLLECTOR

a suction dust collector on such machines as well as of operating the machine itself. The grinding and buffing wheels are partially surrounded by a metal hood, while a fan and receptacle below complete the suction outfit.

Moisture Regulator For Rooms

In heating houses in winter the most common complaint is that the air is too dry. This dryness is usually called to our attention first by its effect upon furniture.

Various devices to provide the necessary moisture are used and among them an electric Humidor. The arrangement of the apparatus is shown in the illustration. A 30 watt incandescent is held partially submerged in the water in the pan and a thermometer regulates the turning off and on of the lamp, according to the

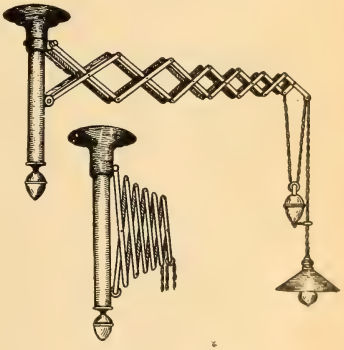


MOISTURE REGULATOR

temperature of the water, the burning of the lamp being thus regulated so that more or less water is evaporated.

Extension Lamp Arm

A convenient fixture for making a single light more serviceable is here illustrated. The Lazilite extension is

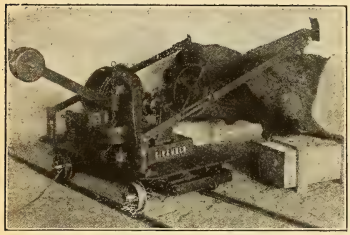


EXTENSION LAMP ARM

constructed of steel strips and enables the light to reach any point within a circle ten feet in diameter by simply moving the lamp to the desired position. The fixture is supplied finished in dull nickel, brass or oxidized silver and is equipped with a cord adjuster for raising or lowering the light.

A "Walking" Saw

Again the mountain seems to be coming to Mahomet, for sawmill operators are learning that it is often easier to move the saw than the timber. Instead of sliding the bulky and heavy log past the saw, the log is rested on any convenient props and the saw teeth are at-

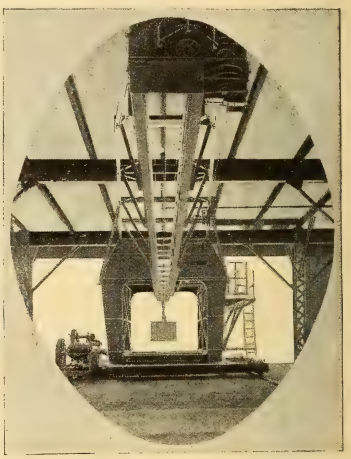


A "WALKING" SAW AT WORK

tached to a chain driven by an electric motor. A couple of sharply pronged arms on the carriage of the motor keep this from moving endwise, so that the cut is made squarely through the log. Then the little car is quickly moved into position for another cut, a single man being able to slide it along while it would take several to move the log.

Unloading the Ships at Montreal

When the warehouses of the harbor of Montreal were built, account was not taken of the possible mechanical discharge of ships' cargoes. When electrically driven unloading apparatus was taken into consideration, it was found that the rooms were too low to permit of the usual type of crane. In consequence a special type of combination gantry crane and derrick was devised. The whole apparatus rests on a wheeled platform, and as this is moved forward toward the entrance the great arm is thrust out over the hold of the ship. A traveling carriage on this arm lets down its ropes and grappling appliances and seizes the box or crate. Then the platform with the whole crane moves back, under the impulse of the motors, into the building and at the same time the



MONTREAL WAREHOUSE CRANE

traveling carriage with its load is run back over the rearwardly extending arm of the crane into the extreme interior.

Truck with Electric Sign

As the electric truck carries a good supply of electric current, it is not

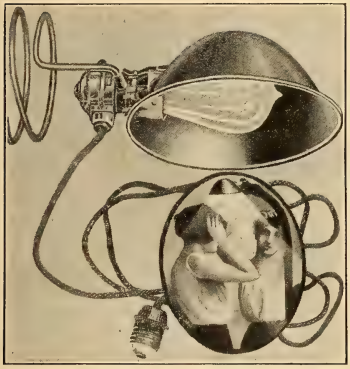
TRUCK WITH ELECTRIC SIGN

strange that one company, at least, has hit upon the idea of installing an electric sign on each side of the vehicle. This may be lettered in any way desired to advertise the goods of the vehicle owner.

The side panels of the truck are made of sheet iron, lamps being installed between them. In each outward facing panel the letters of the sign are inserted. The letters being of glass, the light shines through with good effect.

Handy Lamp Bracket

An eight candlepower lamp would often replace with good results one of sixteen candlepower, if the fixture could be so located that the light shines directly

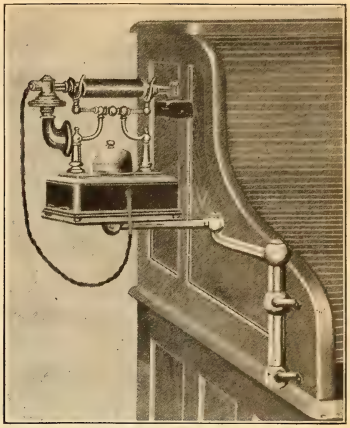


HANDY LAMP BRACKET

on the required place. For looking in dark closets, playing the piano, reading in bed, writing, and for numerous other purposes a direct light fixture is convenient. The device illustrated is attachable to the writing desk, dresser, etc. by means of the coiled spring, which is covered with silk for home and office use, and with rubber for shop service.

An English Telephone Desk Set

The accompanying illustration enables one to compare the English idea of a desk telephone set with the instruments used on this side of the Atlantic. While the American manufacturer arranges the



HOW THE ENGLISH DESK SET IS MADE

bell and ringing apparatus so that it is installed on the wall and is connected by a cord to the transmitter and receiver, which are sometimes secured to an adjustable arm, the English set places the whole somewhat cumbersome looking equipment upon the arm. The receiver and transmitter are connected, the connecting bar serving as a handle for holding the instrument while talking.

Telephone on Church Spire

The new Episcopal Cathedral of Saint John the Divine, in New York City, contains a complete and unique system of telephones, for every part of the big building is linked to every other part through a central switchboard.

There is a telephone at the top of the spire, more than 400 feet above sea level. Another instrument is placed on the highest point of the dome. There is a telephone in the choir loft, while another instrument is at the elbow of the organist.

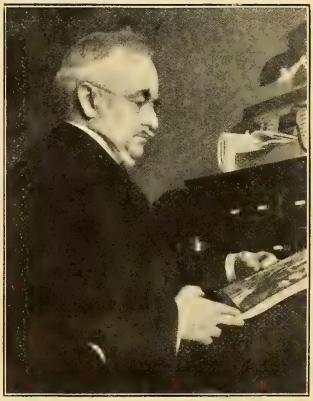
The system extends to the synod hall, where the canons have their offices, and to the choir school.

Electrical Men of the Times

HORATIO A. FOSTER

There is perhaps no better illustration of the youth of electrical science than the fact that Horatio A. Foster, although he did not take up electrical work until he was twenty-six, and is still in middle life, was a pioneer in the days when men were just beginning to learn some of the possibilities of electricity.

Mr. Foster's name is familiar to every one having to do with the practical applications of electricity, through his "Electrical Engineer's Pocket-book," the backbone of every American electrician's working library. Through his connection with such projects as the first Niagara power development, and many large electric lighting and traction installations, Mr. Foster is widely known in his own profession. And it adds interest to his present eminence in his field that, although he is a member of both the American Institute of Electrical Engineers and the American Society of Mechanical Engineers, he never had any scientific training except such as he was able to acquire from practical work with his own hands and brain. Otherwise, as he says, he is a graduate of H. K.—Hard Knocks.



Mr. Foster was born in a suburb of Philadelphia, January 12, 1858, but his boyhood was spent in Northampton, Mass., where he left the High School in 1876 to go to work in a cotton mill. In 1877, at the age of nineteen, he became superintendent of the mill, and in the next six years so increased its efficiency that from being a losing venture it became a ten per cent investment. In 1883 he went to New York to work for Rice & Warner, a firm of railroad contractors.

"One morning in the summer of 1884," says Mr. Foster, "I saw a newspaper paragraph headed, 'A New Profession for Young Men.' It spoke of the possibilities of electrical engineering. I had never heard the term 'electrical engineer,' but I decided I wanted to be one. I had picked up some mechanical engineering in the cotton mill and some civil engineering in my railroad work, but in electricity I had never even so much as wired a bell."

The Daft Electric Company was manufacturing motors at Jersey City Heights. Young Foster got employment there as an apprentice, and less than a year after he started, in April, 1885, he was selected to go to Baltimore, where the Daft Company had taken a contract to equip a two-mile electric railroad for the Baltimore Union Passenger Railway. Two or three experimental electric railways had previously been laid in private grounds and at expositions, but even among electricians there was serious division of opinion as to whether electricity could ever be used successfully for motive power.

At first it looked as though the skeptics were right, for the Baltimore road

consistently refused to run. It was a third rail system, with the unprotected current rail in the middle. Numerous attempts to carry the current from the dynamo to the other end of the track failed, until Foster devised a plan of copper wire bonds for electrically connecting the rails, substantially such as were generally adopted later in street railroad practice. The theory of the unprotected third rail was that a low potential current such as was proposed to be used would not hurt anyone.

"The first day the current was turned on," says Mr. Foster, "a fine Jersey cow with a chain dangling from her neck got out of her pasture and started to cross the track. She got half way across, the chain struck the third rail, and bossy calmly and immediately died. The first car was started that night—there were two of them, named 'Ohm' and 'Volt.' One or the other was in the repair shop all the time. The first one out had gone a few rods when a pinion slipped and stopped it effectively. An old horse started toward the car to investigate. He put one foot on the third rail and departed, via the electric railroad, for horse heaven. The third rail was protected before any more attempts were made."

It was a peculiar coincidence that 21 years later, in 1906, Mr. Foster was the engineer selected to superintend the rebuilding of the entire power plants of the Baltimore electric railroads.

In 1886 Mr. Foster entered the employment of the Thomson-Houston Company and remained with them five years, during which time he was for a year in charge of the engineering department of their Philadelphia business, and for three years superintendent and engineer of their arc lighting plant in New York.

The census of 1890 was the first in which the government took notice of electrical industries. In 1891 Mr. Foster was retained by the census office as chief electrical expert.

Then, early in 1893, he went to Chicago as editor of "Electrical Industries," and made a complete and detailed report for the various issues of that paper on the electrical and mechanical exhibits at the World's Fair. In Chicago he met Professor George Forbes of London, chief consulting engineer for the Niagara Falls Power Company, and at the close of the Fair went to New York to take charge of Professor Forbes' American office. He thus had a hand in the inauguration of the greatest electrical project that had been dreamed of up to that time, and personally worked out many of the details of the great installation, including the methods of testing the huge dynamos. While associated with Professor Forbes he was also, for a short time, editor of "Electric Power." In 1895 Mr. Foster located in Buffalo as a consulting engineer and made for the Cataract Power & Conduit Company what was probably the first accurate series of tests of existing steam and electric power plants that had ever been made in the United States.

In 1906 Mr. Foster became associated with L. B. Stilwell in the rebuilding of the Baltimore power houses, and in 1907 he became associated with Bion J. Arnold, in the appraisal of electric railroad and lighting properties, especially the Metropolitan Traction Company of New York and properties in Southern California.

Mr. Foster's first book, "The Electrical Engineer's Pocketbook," had its inspiration in an early mechanical engineer's pocketbook which one of the mechanics in the cotton mill in Northampton showed him in 1878. The idea of producing such a manual for electrical engineers occurred to him soon after he engaged in electrical work, and he began then accumulating data to be included in it. It was nearly fifteen years later before the first edition was published, but it was the first book of its kind even then. Mr. Foster is devoting himself to the valuation of public utilities and has just brought out a second book, "Engineering Valuation of Public Utilities."

FRANK PARKER STOCKBRIDGE.

Electrical Interests of Women

EDITED BY GRACE T. HADLEY

The Lure of Beauty

"A beautiful woman smiling betokens an empty purse gaping," so runs an eastern proverb, but most women would willingly empty their purse in order to be beautiful. Skin deep beauty carries a conviction that the tactful woman can deepen and make fast with her wits, and if a woman be not clever, if she be lovely, she has a personal asset that allures. Even the clever woman cannot afford to be neglectful of personal charm if she wishes to attract to herself the delighted glance. A woman should attract at first sight, since slow processes do not belong to this day of quick scrutiny and active estimate. The modern woman is not permitting herself to get old and grow gray, even though she may have brought up a suitable family. She goes out of the four walls of her home, joins various organizations and perhaps becomes a club president. But before she does this, with mirror in hand, she has an interview with herself. She considers the practical and beautiful method of winning to herself a large, spontaneous approval.

Suppose she detects some flaws, a line here and there, a wrinkle, a complexion slightly impaired, a dullness of eye, a sagging of the facial muscles—what does she do? The wise woman betakes herself straightway to a modern *salon de beaute,* where a special research has been made in the study of beauty values and where she may call to her aid scientific and hygienic helpfulness. She comes forth a beautiful woman, smiling with a fresh new outlook upon life.

The modern *salon de beaute* is very different from the old-time beauty parlor and the methods of treatment are radically different. There is a spaciousness and artistic beauty about the rooms. The decorations of wall and ceiling and the entire furnishings are exquisitely harmonious. There are reposeful waiting rooms where ladies who come in tired can rest while waiting for an appointment. A cloak and checking room and telephone booths make up some of the conveniences. The part of such an establishment given over to the treatments is complete and sanitary in every detail. The floors are of mosaic, the booths are partitioned in white enameled steel. The chairs are comfortable, the toilet tables handsome. But best of all, every brush, comb, massage device or other article in use in the modern beauty establishment, is freshly sterilized for each treatment.

The modern facial treatment is a complete change from old methods. In the first place it is strictly a cold water treatment. There is no face steaming, no hot water used, no swathing of the face in hot towels. Hot water may be temporarily stimulating, but it makes the muscles flabby and it has a tendency to make the face dry and withered. Mrs. Gervaise Graham was the first to introduce and insist upon a strictly cold water treatment and to discard hot towels and all hot applications. One's face is first cleaned with a cleansing liquid on a bit of absorbent cotton, gauze covered. This is to prevent the cotton from sticking.

Then the hydro-vacu treatment is used. A cold water tank transmits the water through a long rubber tube to a vacuum cap which is gently pressed on the skin and moved about from place to place. The tissues are lifted out of old set grooves and impurities removed. From the vacuum cap through another tube the waste water runs into a pail. The face is then wiped with absorbent cotton and the skin food is applied. Electricity now comes in as an aid to the would-be beauty. It is used chiefly on account of its curative and stimulating effects. The vibrator is too strenuous for facial treatment, but it is highly recommended for body and spinal treatments. Faradic electricity is the kind that is used, beginning with a very gentle current from a dry battery. The operator administers the electricity through her finger tips, one of the connections with the battery being fastened to her wrist. The other is held in the hand of the candidate for the beauty league. The operator works over the skin very carefully and against the lines. All facial treatment must be gentle. The skin is held in place and not moved about any more than is necessary. In scalp treatment the reverse is true. The scalp is agitated as much as possible, to loosen it and make it pliable. Then there is now a tired eye treatment in which electricity is used very successfully.

After the lines and flaws of the face have been treated, the Cupid's bow of the mouth is worked up with the fingers, the muscle about the mouth is gently massaged and the eyes receive a special massage. The throat and back of the neck also receive special attention. The face is cleansed again with cotton and a liquid preparation applied. Layers of absorbent cotton are dipped into cold water and laid upon the face to tone up sagging muscles and make them firm. The face is dried with more cotton and is

powdered and tinted. The eyelashes and eyebrows are lightly brushed and touched up. When the would-be beauty regards herself in the mirror, the story of the mirror pleases. It is an eloquent song without words.

"Very good," says the plain sister who lives far from an artistic *salon de beaute*, "but what can I do to be beautiful? How can I help myself, if I live in a suburb or a small town?"

You can learn a few simple rotary movements and treat your own face. You must have a good cleansing cream or liquid, a pound of absorbent cotton and you should have a small dry battery with two soft rubber sponges with which to treat your face. Do not use the vibrator on the face. Keep it for body treatments. You may be able to give yourself the hydro-vacu treatment, as it is easy to use and surely every woman has at hand plenty of fresh cold water. If your face requires special treatment it is best to consult a specialist.

There are many types of fascination in faces and it is possible to acquire an ally in a clear complexion or lovely tinting. The wise woman acquires tact, serenity, poise and a certain composite quality called charm. The lack of allurement may be wholly a lack of systematic effort on the part of many women.

A Window of Blooms by Lamp Light

Here is an artistic window that tells an interesting and effective story, a window of blooms brilliantly illuminated. When the breath of winter was still in the air, the window was full of the promise of spring. It was warm with light and color. There was the creamy white of the lilies, the delicate tints of the roses, the purple of the violet, the rich hues of the carnations, the color tones of the tulips all mingled, but harmonious in arrangement. Every one agrees that goods properly displayed will practically sell themselves, especially if they are efficiently lighted. This window is illuminated by an imported French crystal prism fixture and two small side lights. Eleven 40 and 60 watt tungsten lamps are concealed within the central fixture.

LIGHTING A FLORAL WINDOW DISPLAY

Artistic window dressing is worth while. It attracts the eye. It makes people stop and look. It makes them want to buy. The object of a lighting fixture is first of all to provide illumination. Satisfactory illumination means that you have neither too

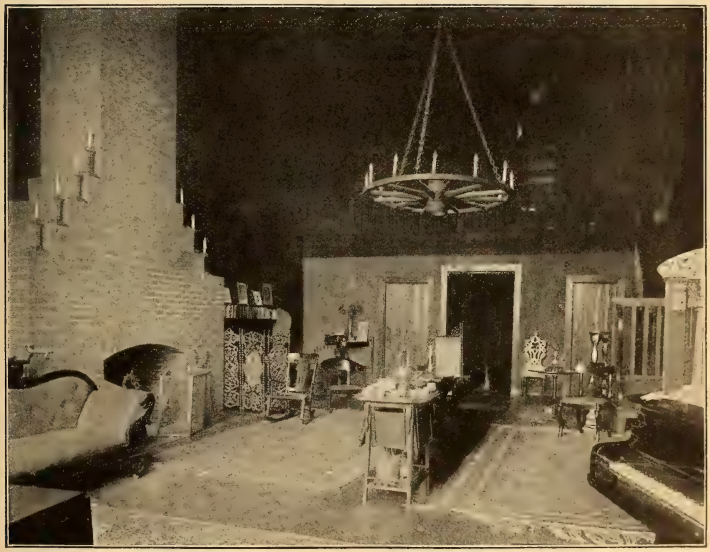
much nor too little light and that the light sources do not offend the eye. Art in the window display is an expression of the owner's individuality. Gorgeousness and splendor are not essential elements of true art. Delicacy of decoration is important.

A Wagon Wheel Chandelier

The most striking feature in the drawing-room of Mrs. Katherine Gillette-Hill, a wealthy resident of Washington City, whose house is a model of artistic adornment for the palaces now being erected there, is the electric chandelier pendent from the center ceiling.

This chandelier consists of a wagon wheel; not a make-believe wagon wheel, but the real old fashioned, iron rimmed affair of the early fathers. It is made of highly polished black oak, with wrought iron tire and spokes, boxes and hub complete. It is suspended from the ceiling by three chains of burnished copper, which hold it horizontal, with just enough play to permit a gentle swing to and fro.

At the points where the spokes join the rim, there rise porcelain candles on the tips of which shine incandescent lamps. The under side of the hub is concave to receive a curved reflector of polished metal in the center of which is an incandescent lamp of high candle power, thus concentrating, when desired, a powerful light, in the nature of a drop light, throwing its rays immediately below the chandelier.



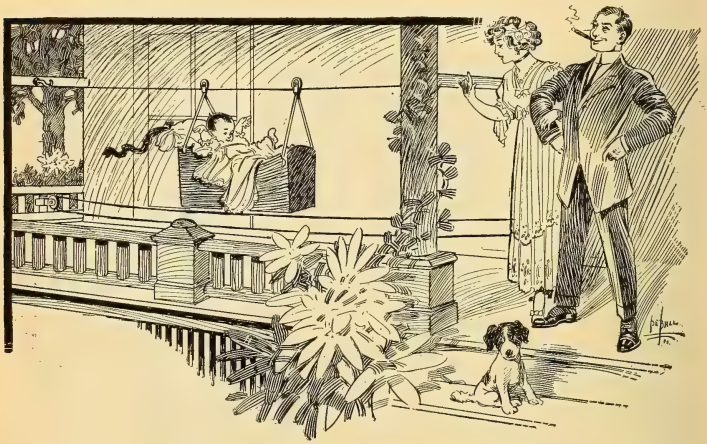
WAGON WHEEL MADE INTO AN EFFECTIVE CHANDELIER

The idea of this most original chandelier was suggested to her, says Mrs. Gillette-Hill, from her memories of the early pioneer days of Illinois, her former home, when the meeting houses of the settlements were oftentimes lighted by candles fixed on the rim of a wagon wheel suspended from the ridge pole.

Trolley Cradle for the Baby

A certain city in South Carolina owns its lighting plant and employs a young man as superintendent who is an original and enthusiastic electrician. He recently became the father of a vigorous son who demanded a great deal of attention, a large part of which was contributed by the father in rolling a baby carriage up and down the long shady porch. It was here that electrical genius came to his aid.

A strong iron cable was strung the whole length of the porch. A little crib with wheels on it something on the order of a cash basket in a dry goods store was made and suspended on the cable. By means of a cord attached to the crib and operated by a sewing machine motor the crib moves along the cable and when it reaches the end the motor is automatically reversed and the crib goes to the other end and so on. By the turning of a switch the baby is kept quiet and happy indefinitely.



A NEW WAY OF ENTERTAINING THE BABY

Bridget's Change of Heart

"I'm leaving in a week, ma'am," announced Bridget, feeling sure that her words would strike terror to the very heart of her mistress, who had a luncheon party scheduled for Wednesday.

"Very well," said her mistress, sweetly, "I already have a servant in the house." It was Bridget's turn to be shocked at the equanimity of the mistress.

"Faith, and who may it be?" faltered the cook.

"Have you forgotten that I had the house wired last week and that I now have electricity at my service? I have ordered a vacuum cleaner, a toaster stove and several other electric cooking utensils, so that I shall not be entirely helpless, and I can cook, you know."

Bridget trudged down the stairs and prepared dinner. The next day she announced that Patrick was wanting to marry her, but that she would stay awhile and oversee the new servant.

House Wiring a Simple Problem

During the past four and a half years, 3,350 homes have been wired for electric service in Chicago. Since August, 1907, the owners of unwired houses and apartments have been induced to have their premises wired on the instalment plan, the local light and power company doing the wiring and furnishing the fixtures at cost and spreading the payments over a period of two years. The general impression was that there would be considerable damage to woodwork and decorations, but this impression was soon dispelled by the methods used by expert wiremen. The wires are fished between partitions and under floors to avoid making holes in the plaster or injuring the woodwork. A flexible metallic conduit protects the circuit wires completely and still enables them to be fished around corners and in loops. An experienced wiring man is able to get around almost any structural difficulty without having to cut the plaster to reach the outlet. Sometimes it is necessary to remove a baseboard or a single board in the flooring, but these are easily replaced without a trace of disturbance.

A small cottage may be wired for ten lights, the lights being placed as follows: Hall one, parlor four, back parlor three, and one light in each of two bedrooms. The average cost of wiring cottages of this kind in this manner is $45.00, not including fixtures. Spreading the cost over a period of 24 months, as is done by the Chicago company, makes each monthly payment only $1.88. For complete wiring of a two-story frame residence, a two-story brick apartment and a three-flat building the cost ranges up to $275, in the last instance including fixtures. Wiring is not so much an expense as an investment.

The possibilities of electrical service in the modern home are so self-evident that it seems almost unnecessary to enumerate them. There is the facility for flexibility and convenience of control. Electricity as an illuminant is safe and sanitary and in many cases it is an actual domestic economy. There is the broad application of electric service to so many of the household processes and it is a practical solution of the servant problem.

Radium Baths in Bohemia

The old town of St. Joachimstal at an elevation of over 2,000 feet in the Ore Mountains, about 20 miles north of Carlsbad, was once famous for its silver mines. Long after the silver and copper mining activities of St. Joachimstal had come to an end, other ores, more particular uranium (pitch-blende) were mined there. However, it is only since the discovery of radium that the St. Joachimstal uranium deposits have become famous. They are richer in this most precious metal than any similar deposits in the world.

The chief use of radium is for medicinal purposes and recognizing this, the Austrian government several years ago installed a provisional bath house near the mines. It was then demonstrated that the radium treatment was helpful in cases of gout, rheumatism, neuralgia and similar diseases. The building of a modern "cure house" was begun at the mines and this structure was formally opened on October 22, 1911, in the presence of various high government officials. The building is equipped with the latest and most practical devices for the application of radium therapeutics.

The "radioactivity" both of water and air is utilized in these cures. The new bath establishment has numerous bathrooms where warmed radioactive water from the uranium mines is available in tubs, the exact degree of radioactivity necessary for every case being carefully regulated. Besides the emanation from the water through the skin, provision has been made for drinking the radioactive water as well as inhaling radioactive air. The very latest scientific inventions are used to preserve the radioactivity of the waters.

Artistic Electric Candlesticks

A pretty candlestick is always a welcome addition to any table, mantel or dresser and is the more attractive when

CANDLESTICKS OF DECORATED GLASS

made to use electricity. The candlesticks here shown are real works of art in glass working and are arranged to be equipped with a small electric lamp and finely finished silk cord with a plug for connection to the nearest lighting socket. The base of metal finished in almost any desired style adds to the beauty of the decorated glass portion.

An Advantage of Electric Cooking

One of the advantages of electric cooking which should appeal to the housewife is the fact that a moderate temperature may be used, with a resulting preservation of weight and bulk of the material, as compared with flame cooking at high temperature. The result is not only an improvement in the quality of the material after cooking, but it has been shown recently in the *Standard* that it may actually affect the amount of the butcher's bill. Figures are given covering four years for a family of six persons, who, as far as is known, partook of meat just as often in the two years under electric cooking as in the two years under the use of gas. There was a slight increase in the expense for heating, cooking and lighting, amounting to from $10 to $25 per annum. There was a decrease in the butcher's bills, however, amounting to $80 per annum.

The statement that the shrinkage and evaporation is much lower with electric cooking is substantiated by a caterer's journal, which estimates this loss as low as six per cent with electric cooking, whereas it reaches 18 to 20 per cent with other methods.

A Demonstration by the Visiting Lady

The dining room was beautiful. The table was mahogany, with a spotless white cloth. In the center was a gilded basket filled with ferns and purple violets, so real that fashionable persons without their glasses mistook them for the large blooms of early spring. A heavy handsome dome was suspended above the table, which was laid for breakfast. Electricity as an illuminant was very much in evidence.

Out in the kitchen the chocolate colored cook was struggling with an unwieldy gas range. She tried to make toast in the oven of the gas range—and burned it badly. The visiting lady who happened to stroll into the kitchen took in the situation at a glance. She hastened upstairs and soon returned with an electric disk stove which was tucked away in her trunk. This she attached to a lamp socket under the dome of the dining room table. When the house lady, her daughter and another guest sat down at the table, the visiting lady was busy making toast on the electric stove. The colored cook entered apologizing for the scorched toast.

"Never mind," said the visiting lady, "I am serving the brownest of toast hot off the grid. An electric disk stove is not really the proper utensil with which to make toast. One should have an electric toaster, but I want to show you just how easy it is to have hot brown toast made right at the table, instead of

badly burned toast that tried to make cinders of itself in a gas oven."

The cook was open mouthed with astonishment. The house lady was deeply interested. She used electricity most recklessly as an illuminant, but this was the first demonstration in cooking with electricity that had ever been made in her home. Like thousands of other women, she had not waked up to the possibilities of table cooking.

"And that is all you have to do!" exclaimed the house lady, "simply attach the cord and turn on the current?"

"That is really all that is necessary," said the visiting lady, "and electricity will make you the best and brownest of toast. Best of all you can have it hot, which is the first requisite of good toast."

Table Decoration at a Southern Dinner

"We had a delightful time in New Orleans," said Mrs. T. to a visiting friend, "but nevertheless we are glad to get home again. We were entertained a great deal and driven about the quaint old city in a very fine limousine; in fact, we had so much attention shown us that we felt duty bound to reciprocate. As we were stopping at a hotel I could think of no better way to do this than to give a dinner party. The first thing that perplexed me was the matter of table decoration. There were loads of violets to be sure, and many small flowers but I did not care to use them, neither did I care to indulge in American beauty roses at seven dollars a dozen; these are shipped south from Chicago, hence their increased cost. Finally, I consulted the hotel manager and told him I wanted American beauty roses, but I felt that the price of imported roses was rather prohibitive, and I asked him what I could use for table decoration.

"Well," he said, with that promptness so characteristic of the up-to-date hotel manager, "we have a basket of electrically lighted roses that will appeal to the most fastidious taste."

"Now, I was somewhat dubious at first, as I had never used anything in the way of table decoration, except the fresh cut flowers, but when I saw this basket of electrically lighted roses in the center of the table I was delighted with it. There must have been at least two dozen roses in the basket and garlands running from the basket to each plate; the roses were remarkably true to Nature both in color and form and the flexibility of the wiring made it easy to carry out a beautiful wheel design. Fresh green smilax was used in profusion and completely hid from view all traces of the wiring. The effect was most realistic and the whole arrangement so artistic that it presented a fairy-like scene. I was more than pleased with the idea and my dinner party was a great success."

Business Methods Good for the Home

An English woman writer has pointed out that the functions of the home are protective, educational and social. The household produces use values, while other organizations produce exchange values. The home is not operated on profit making lines. The absence of profit making has certain drawbacks. While business houses have had competition to urge them on to better things, the household has remained in a more or less backward state. Housekeepers continue to use old-fashioned utensils and ranges and antiquated systems of water heating. Inventions make way more slowly in the average home than in a profit making industry.

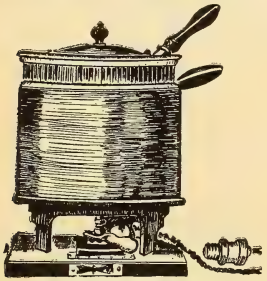
The electric era is here. Business houses are rapidly installing electrical apparatus to do their work and housewives are gradually waking up to the fact that there is a Servant in the House, ready to do their bidding at the turn of a switch.

It does not follow that the place in which we dwell need be made any less

homelike by adopting business principles and business methods, or be turned into a private hotel and café. It simply means that that great word "efficiency" which so stirs the business world might well be better understood and respected in the home.

Combination of Cereal Cooker and Stove

An ideal way to prepare breakfast is afforded by the double boiler combined with the electric stove. The inner vessel is made of white porcelain and the outer one is of copper, double tin lined and nickel plated. This can be used alone



CEREAL COOKER AND STOVE

on the stove as a single boiler. It holds half as much again as the porcelain vessel. The electric stove is mounted on a slate base, is furnished with six feet of cord and a lamp socket plug. The cost of operating this combination is not great. Three heat stoves are recommended as they permit an accurate control of the cooking, and save current.

Mental Character Determined by Machine

A British scientist announces that he has invented a machine by which the mental character of a person may be determined. It looks like a box camera, and has a revolving mirror. Flashes of colored light are thrown rapidly into the mirror and reflected into the eye of the subject. It is said that the sensation of color persists for a short time after the external impulse has ceased. The duration of this persistence and a scale of perseveration are the means by which the scientist takes measurement of character by electric lights.

Fundamental Principle of Electric Cooking

Loss of heat by radiation from a coal or gas stove is very great. This is practically eliminated where an electric range, or, in fact, any electric cooking device is employed. The fundamental principle of electric cooking is that the heat is where it is wanted and nowhere else.

The Kitchen to Become a Laboratory

"Instead of feeling like a drudge in a smoky, smelly, overheated kitchen," states a writer who has made a study of foods and their preparation, "the housewife and the professional cook of the future will have the dignity of working in a clean, cool laboratory for the scientific preparation of savory food, and the abolition of dyspepsia. On the principle that prevention is better than cure, they will take the place of physicians."

Cleaning of Bulbs and Reflectors

Housekeepers who will spend several hours a week cleaning house, who dust, scrub and polish, often pay too little attention to keeping their electric lights and reflectors clean.

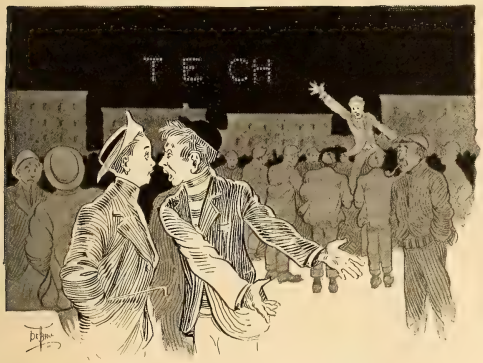
They will keep their windows clean, and are worried if they are the least bit streaky, keeping out the daylight. But the electric lights they neglect. They will not waste the daylight, which costs them nothing, but are profligate with electric light, for which they have to pay.

In some instances it has been found, due to dirty globes and reflectors, that people are getting only one-half of the light for which they pay. A damp cloth will soon remedy these conditions.

Junior Section

A College Prank

In commemoration of its 125th anniversary, the University of Pittsburgh employed an electric signboard 40 feet long and fifteen feet high in a prominent location, bearing the inscription: "1787—



"THEY HAVE STOLEN OUR ADVERTISING"

University of Pittsburgh—1912." In a spirit of levity students of Carnegie Technical School, which is also located in the city of Pittsburgh, stole the advertising.

The letter "T" was used; "B" was converted into "E" by severing several wires; "G" was made into "C" and the letter "H" appropriated. All other lights were cut off and when the sign was turned on at night "TECH" blazed forth.

Electricians after many hours splicing succeeded in correcting the sign before the three day celebration was ended.

Electrifying the Checker Game

Genius invents an electrical checker board which will add much interest to the old diversion. R. C. Jackson, of 31 Green street, Dayton, Ohio, has electrified the checker game. The game with Mr. Jackson's invention triples the psychological element involved, the skill, the ingenuity and the interest in the ordinary checker game. The unique new checker board comprises an ordinary 64-square board. Each square on which the checkers are moved is faced with two copper electrodes, or contacts. Each player is provided with a plug board, properly screened from the view of the opponent. Each plug board has a contact for each playing square on the board, which makes a duplication of the main board, and by means of a flexible cord either player may "plug in" on any square on the board upon which he calculates that his opponent will move.

If the player whose turn it is to make a move really does move his checker onto the square so plugged, the move rings the alarm, which is a small electric buzzer. In every instance the player who in moving rings the alarm, is compelled to move back to the square he left. This, of course, is a deviation from the usual game. In moving back

he loses his move in the play. If, however, a player moves to a square not anticipated by his opponent the move is to his credit, just as in the ordinary game.

In beginning the game the men occupying the king row are termed "royal guards," which is another slight deviation from the customary game. As long as the king row contains "royal guards," or men who have not been moved from their original position, these four guards must be surrendered, one by one, to the opposing player as fast as the opposing player forces his opponent to ring the alarm by the moving of any of his other men.

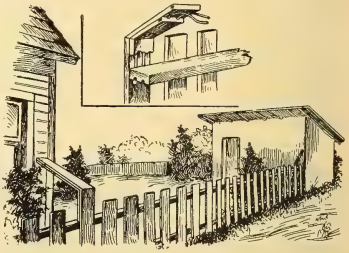
By this new rule it will be readily seen that in the new game there is at once one grand break to vacate the king row for fear of being forced to surrender the four "royal guards." These first four men are the only ones surrendered without being "jumped." If they can be gotten out of the king row before the player is compelled by his opponent to ring the alarm there is then no danger of losing them by surrender. No player can "plug" against a single jump, and a single jump must be taken. If a player is presented the choice of two or more jumps then his opponent can "plug" him on either of two co-ordinate jumps or on the second of a serial jump. Not more than two or three games will be required to convince any player that the psychology of the checker game is involved to about three times the extent of the common checker game.

The checker, or "man," in the new game is an ordinary checker jacketed with sheet metal, which serves as a contact to complete the circuit and ring the alarm when it is placed upon a square the electrodes of which have been charged.

The electrical energy for the board is supplied by a single cell dry battery, and the raising or lowering of either player's screen covering his plug board automatically cuts the current in or out of his end of the board.

Fooling the Chicken Thief

In running wires from the chicken house to a dwelling for the purpose of sounding an alarm in case some one should unlawfully seek the "makings" of a chicken pie it is quite essential that the wires be deftly concealed, otherwise they would be easily discovered by the thief and disconnected. In the case of



METHOD OF CONCEALING ALARM WIRES

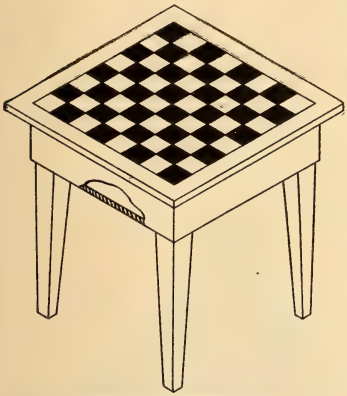
a closed circuit system this would mean putting it out of service. Such wires might be placed in a metal pipe or conduit underground, but this is rather expensive.

I have installed wires in the manner shown in the illustration and in very few instances has my attention been called to them by some sharp-eyed observer. The illustration is self-explanatory. From the house two horizontal boards extend to a pair of vertical boards on the fence. Between the boards in grooves are the two wires. From the vertical boards at the dwelling the wires pass through to the under side of the 2 by 4 of the fence and thence toward the hen house. Here an arrangement similar to that from the dwelling to the fence is provided. Sometimes the disguise may be made more complete by having the horizontal board over a gate at the front and also at the rear, the wire carrying boards appearing to be a part of the wooden framework of the gates.

BOHUMIL KREJCIK.

Illuminated Checkerboard Table

The top of this table is made of glass, preferably ground, on the surface of which a checkerboard is painted. The lower part of the table is built in the ordinary way except that a box-like structure is placed directly beneath the glass. This is enclosed so that a light



ILLUMINATED CHECKER BOARD

or lights may be introduced. These lights may be permanent and so arranged that a connection may be plugged into the lamp socket. C. H. Sampson.

The Ambrose Channel Lightship

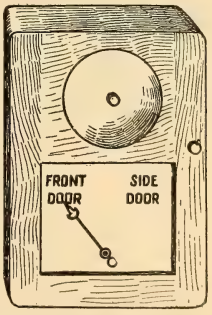
As a result of a series of tests which extended over a year and were made by the United States Lighthouse Department, the Ambrose Channel lightship, marking the eastern end of the new channel into New York Harbor, has been equipped with flame arc lamps. There are two signal masts, each carrying three lanterns of standard lighthouse design hung in gimbals in order that the plane of illumination may be maintained horizontal regardless of the motion of the vessel. A vertical type carbon flame arc lamp, working at 110 volts and 6½ amperes, and giving a

AMBROSE CHANNEL LIGHTSHIP

maximum horizontal candlepower of approximately 4,000, is placed in each lantern. The arc is placed at the focus of the lens, which is so arranged that the light emitted is concentrated, and passes from the lens with a divergence of about eight degrees, the result being that a powerful cone of light is projected horizontally. The three lanterns are spaced at equal distances about the masts, and at least two of them are visible from any point of view. At a distance of approximately two miles the two lights apparently merge into one light source.

Caller Is at Which Door?

A number of bells in a house is rather confusing as it is hard at times to determine whether it was the front, side or back door bell which rang. To do away with this troublesome feature a combined bell and annunciator has been recently placed on the market, which indicates the door the caller is at. Only one bell is used and the annunciator automatically resets itself.



DOOR BELL ANNUNCIATOR

Paris Engineer's Odd Dining Room Railway

M. Hagnauer, a noted electrical engineer of Paris, has devised for the amusement and instruction of his little daughter an ingenious electric serving railway for his dining table. He has built a little track running from the slide connecting his pantry and serving room with the dining room, on which runs a little motor engine run by current from the city supply. Attached to this is a car on which can be loaded bottles of wine, plates of food, etc. The railway completes a circuit around the table, so that dishes can be placed upon it and sent back over the track to the pantry slide. M. Hagnauer can operate the railway from his seat at the table, by means of a little dial having push buttons around its face, each one controlling a different movement of the motor, such as starting, stopping, reversing, etc. A cord carrying the controlling wire runs from this dial along under the railway to the pantry, where it is connected with a switch attached to the electric light circuit. It has proven to be of much practical use, besides affording continual amusement for his little daughter.

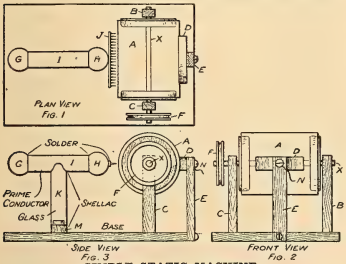
PARIS ENGINEER WHO AMUSES HIS LITTLE DAUGHTER WITH A DINING ROOM RAILWAY

A Simple Static Machine

The accompanying illustrations show a cylinder electrical machine that is very

simple in its construction and operation. Fig. 1 shows a plan view of the machine, Fig. 2 a front elevation and Fig. 3 a side elevation.

The glass cylinder is four inches in outside diameter and five inches long. This is designated by (A) in all the illustrations. Two pieces of well seasoned oak are cut to shape so that they will fit in the ends of (A). The axle (X) is 7½ inches long and ¼ inch in diameter. The end pieces and axle should be glued



SIMPLE STATIC MACHINE

or shellacked in place and allowed to dry firmly. The two uprights (C) and (B) are made of well seasoned oak and are five inches high and ¾ inch wide and ½ inch thick. They are fastened to the base by means of screws passing up from underneath. They have ¼ inch holes drilled in them so that (X) will fit in. A pulley (F) is put on one end. This can either be flat or grooved as desired.

The base is of well seasoned oak and is ½ inch thick. All the wooden parts should be given two coats of shellac and allowed to dry well.

The rubber is shown in (D) in the illustrations. It is three inches long. A piece of wood three inches long, ½ inch wide and ¼ inch thick is wrapped with about four turns of flannel and then covered with two turns of silk. This piece (D) is fastened to an upright (E) by means of a short round head brass screw. (E) should be so placed that the rubber (D) will press firmly on (A). The brass screw is connected to the ground by means of a wire (N). The rubber should be kept covered with an amalgam which is made as follows: Melt together in a ladle, two parts of zinc and one of tin. When melted add six parts of mercury and pour the mixture in a wooden box and shake well until cool. When used, this amalgam should be mixed with a little lard and rubbed over the rubber.

The prime conductor (I) is made as follows: Secure a piece of brass tubing having a one inch outside diameter and four inches long. On each end solder a brass ball 1½ inches in diameter (G) and (H). Get a piece of strip brass ¼ inch wide and 3½ inches long. Drive a number of brass tacks in it as close together as possible. Solder all the heads to the strip. Then solder the strip to (H) with the tack points away from the prime conductor. Round off all sharp corners except the tack points. Connect the prime conductor to the base by a piece of glass tubing one inch in diameter and of a height that will bring the points of the prime conductor on a center with (A). Cut a piece of wood so that it will fit tightly in the glass tube (K) and screw it to the base. Put the tube (K) on this and glue firmly. The prime conductor (I) is placed upon (K) so that the points (J) will almost touch (A). Then fasten (I) to (K) with shellac or glue. The machine is now complete.

Carefully dust off all parts of the machine and warm well before the fire. Connect the rubber to the ground and turn the glass cylinder (A) briskly. A stream of violet fire will flow from (A) to the points on (J). If the knuckle is brought near (G) a sharp spark will jump and quite a powerful shock will be felt. This spark under favorable conditions will be from one to three inches in length.

To charge a Leyden Jar with this machine connect the outside coating of the jar to the ground and bring the knob of it near the knob on the machine. In a few seconds the jar will be charged.

B. FRANCIS DASHIELL.

Interference and the Inductive Tuner

By MARLIN O. ANDREWS

When the wireless operator comes to the practical operation of his set, he must shift for himself. He must learn to tune, by pulling a slider here, pushing another there, adding capacity somewhere else, until he brings in a station free from interference. Then he pats himself on the back and thinks he is becoming an expert. He copies only a few words, however, when another station or two come roaring in, bringing with them a mixture of surprise and despair to the late expert. He gropes for some time with a maze of unintelligible sliders, switches, coils and condensers, having about as much chance of tuning out the undesired signals as if he were trying to work the combination of a safe.

The majority seem to be looking for new apparatus, new systems of tuning, never stopping to think that perhaps they are not getting the greatest possible amount of selectivity from the instruments which they already have.

In any transmitting set using the ordinary spark gap, the oscillating and radiating circuits, whether direct or inductively connected, have, if not too loosely coupled, two periods of vibration, one longer and the other shorter than the natural period of either circuit. This is due to the interchange of energy between the two circuits.

If the common turns of direct connected circuits are decreased in number, or the distance between inductively connected circuits lessened; in other words, if the coupling is loosened, it is found that the coupled circuits still have two periods of vibration, but they have approached nearer to the natural period of each. It is, therefore, possible to loosen the coupling to such an extent that both circuits will vibrate in the same period and only one wave be radiated. When this is done the reading of the hot-wire ammeter in the radiating circuit will be lowered, due to the greater losses of loose coupling. However, this does not necessarily mean that the audibility of the signals at the receiving station will be decreased, since the meter registers the total amount of energy radiated, whether it is in one wave or divided between two. Therefore, signals are of the greatest audibility at the receiving station, when the transmitting set is closely coupled or is sending out two waves and the receiver is in tune with both. The next best condition is to have the transmitter loosely coupled and in tune with the single wave.

It is due to this double periodicity and consequent radiation of a double wave that we can receive from a station at two places on our tuning coil.

At first thought it would seem that this double wave length would be detrimental to good tuning, which is true in the hands of one who does not understand its value. With a little thought, however, it is possible to obtain greater selectivity with stations using a double wave than with those radiating a single wave.

Let us now consider the action of an inductively coupled receiving set in regard to the receiving of double waves.

In this set, if we have variable condensers in parallel with the primary and secondary circuits, we plainly have variable quantities, the inductance in the primary circuit, the inductance in the secondary circuit, the coupling between the two circuits, and the capacity of the condensers. By careful experiment we find the effects of these variations, on both the long and the short waves to which we are tuned, to be as follows:

1. Increasing the inductance of the primary increases the long wave length rapidly but the short wave length is increased so slowly that it may be considered as remaining constant. The opposite is, of course, true when inductance is taken from the primary.

2. Increasing the inductance of the secondary increases both the long and the short wave lengths equally, or nearly so, and vice versa.

3. Loosening the coupling between the primary and secondary decreases the long wave length and increases the short wave length. Tightening the coupling increases the long and decreases the short wave lengths. In other words, its action is the same as the oscillation transformer of the transmitting set. As the coupling is loosened the two wave lengths approach the wave length to which each circuit is individually tuned, and as the coupling is closed the two wave lengths are driven farther from the natural wave length of the circuits.

(Note.)—To have loose coupling does not necessarily mean to have the secondary pulled out from within the primary. We may have loose coupling when the secondary is totally within the primary. The point of maximum or closest coupling is reached when the middle of the active primary turns is directly over the middle of the active secondary turns. Then, if the secondary is pushed still farther within the primary, the coupling is loosened, giving us two points of loose coupling on either side of the point where the coefficient of coupling is maximum. This is important and should be thoroughly understood.

4. Increasing the capacity in the primary circuit increases both wave lengths, and vice versa.

5. The variable capacity in the secondary circuit is used principally to put the secondary in resonance with the primary, thereby allowing looser coupling than would otherwise be possible. This allows atmospheric disturbances to be cut out to some extent without decreasing the audibility of the signals.

We have already observed that it is possible to hear a station radiating a double wave at two places on our tuner. In one case, we are in tune with the long wave and in the other with the short wave. We may also be in tune with both the long and the short waves at the same time. This is a decided advantage as we will then receive energy from both waves, and the signals will consequently be much louder than when tuned to only one of the waves.

How may the different types of interference be avoided?

Case 1. When in tune with the long wave length of the transmitting station, there are four principal types of interference that we must dodge.

1. Another station may commence sending, whose long wave is of the same length as the one which we are receiving, but whose short wave is either longer or shorter than the short wave of the station from which we are receiving. For instance, suppose we are receiving from a station radiating waves of 1,500 and 500 meters respectively. We are tuned to 1,500 and 400 meters, and another station commences sending using waves of 1,500 and 600 meters. By referring to the effects of coupling on double waves we find that this type of interference may be tuned out by simply loosening the coupling which lowers our long wave length perhaps to 1,300 meters and raises our short wave length to 500 meters. The desired signals will then come in not on the long wave, but on the

short wave, where there is no interference. If the coupling is loosened too much our short wave length will be raised to 600 meters, where the undesired signals will again be picked up.

2. While we are still tuned to 1,500 and 400 meters, and are receiving from a station radiating waves of 1,500 and 500 meters, another station may begin sending, using a short wave of 400 meters and a long wave, either longer or shorter than 1,500 meters. It may be tuned out by adding capacity to the primary circuit, which increases both wave lengths to 1,700 and 600 meters, then by loosening the coupling our long wave length is again brought back to 1,500 meters and our short wave length driven still farther from the interference at 400 meters. The desired signals will again come in on the long wave but our short wave length has been raised to 800 meters, where it is comparatively safe from interference, as there are very few stations using wave lengths of from 600 to 900 meters.

3. Tuned as before to 1,500 and 400 meters and receiving from waves of 1,500 and 500 meters, we may get interference from waves of 1,500 and 400 meters. In this case, we are in tune with both waves of the interference and the desired signals may be entirely drowned out. This may be overcome by simply adding inductance in the secondary or capacity in the primary circuit, either of which raises both our wave lengths to 1,600 and 500 meters. We will then get our station on the short wave where there is no interference.

4. Under the same conditions as before, suppose a station begins sending, both waves of which are of exactly the same length as those of the station from which we are receiving. If there is no difference in the tone or intensity of the signals, we must wait our turn, as there is positively no way of getting around this type of interference. However, this is, fortunately, a very rare case and will not often be encountered.

Case 2. When in tune with the short wave length of the transmitting station, the types of interference are similar to those under Case 1, but the remedies are slightly different. One example will be given here, and the reader may work out the rest for himself.

1. We are tuned to 1,500 and 400 meters, and are receiving from waves of 1,600 and 400 meters. Interference of 1,400 and 400 meters may be tuned out by adding inductance in the secondary circuit or capacity in the primary, either of which will raise our wave lengths to 1,600 and 500 meters. The desired signals will then come in on the 1,600 meter wave.

Questions now begin to come up. How can we tell to which wave we are tuned? This sounds well on paper, but in practice how are we to determine whether we are tuned to the long, to the short, or to both waves? Nothing could possibly be more simple. All we have to do is to add inductance to the primary and observe the result upon the intensity of the signals. If the signals are cut out altogether, we are in tune with the long wave, if the signals are not affected or are only slightly decreased in audibility, we are in tune with the short wave, and if they are not cut out entirely but their audibility is considerably diminished, we are in tune with both waves.

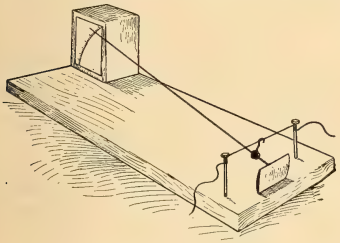
Is it not possible to strengthen weak signals by these methods? It certainly is. For instance, suppose we are receiving from 1,500 and 500 meter waves and are tuned to 1,500 and 400 meters. If the signals are weak, they may be strengthened by first increasing the inductance in the secondary until we are tuned to 1,600 and 500 meters. The signals will then come in on the 500 meter waves. Then, by taking half as much inductance from the secondary as was added to it, and loosening the coupling, we become tuned to 1,500 and 500 meters and are getting energy from both waves and consequently stronger signals.

Let us take another case. Suppose we are tuned to 1,500 and 500 meters and wish to strengthen the signals which we are getting from waves of 1,600 and 500 meters. Increase the inductance in the secondary, until the signals come in on the 1,600 meter waves, then take half as much inductance from the secondary as was added to it, and tighten the coupling. This brings us in tune with both waves.

A Hot Wire Meter

A very successful and delicate hot-wire meter may be made by anyone, at a net cost of ten cents. Following is the list of necessary materials: A twelve-inch hatpin; small stick of sealing wax; safety razor blade; one foot fine German silver wire; board for base, and two three inch nails.

Drive the nails firmly into the base near one end, about six inches apart.



HOT WIRE METER

Stretch the fine wire across the tops of these nails rather tightly. Fasten the head of the hatpin to the middle of the razor blade with sealing wax, and also fasten a small loop of bell wire, an inch or less long, two inches out from the head of the hatpin. These measurements are approximate and need not be followed absolutely. Finally, make a scale of any convenient small divisions and pin it on a cardboard box of some kind. It will probably be necessary to stick a chunk of wax on the razor blade to weight it down. Simply hook the loop of stiff wire over the middle of the fine wire as in the illustration, and place the scale beside the pointer.

Make your connections to the two nails, shunt the meter across three or four feet of the aerial circuit. The deflection of the needle varies directly with the current going into the aerial and is greatest when the aerial and condenser circuits are in resonance.

H. E. Rawson.

Ships of Navy to Report Positions

The United States navy department has issued orders to all vessels of the navy to send "position reports" when within range of wireless stations, giving their location, course and rate of speed. With this information on file, the position of a boat may be easily calculated and with the operators of naval wireless stations vigilant day and night, the nearest boat to one sending distress messages may be despatched without any loss of time.

Wireless News for Desolate Islanders

The inhabitants of the Magdalen Islands in the Gulf of St. Lawrence are entirely cut off from communication with the outside world all during the winter months. In order to keep in touch with affairs, the Postmaster General of Canada is arranging to have a weekly news letter sent them by wireless. The letter, which will be about 1,000 words long, containing a brief summary of the news of the world, will be sent to the clergy who will read it at the close of the Sunday services.

Wellington, New Zealand, will very soon have a long distance wireless station of very high power. The station is being erected on the top of Otari Peak, nearly 1,000 feet above sea level. The masts, two in number, will be 150 feet high. With this station wireless communication will be possible with Sydney, Australia.

Restoring Old Hard Rubber to Its Natural Color

All wireless amateurs who have ever paid a good price for some high class instrument, know how disappointing it is to find that the hard rubber parts have slowly but steadily changed to a spotted yellow color. I have run up against the same problem more than once, and so made up my mind to find some remedy for the trouble. Finally, after many experiments, I found a very simple method that makes the rubber good and black, and gives such excellent results that it pays well for the small amount of work.

Here is the way to do it. Simply saturate a small clean rag with full strength household ammonia, and rub the faded surface of the rubber with it until the cloth becomes dry. Repeat this operation a few times, and you will find that all the yellow color has disappeared. Always be sure to rub in one direction, so as not to mar the face in any way. After you have removed all the discoloration by the above process, polish up the surface with a piece of silk moistened in crude oil.

I have treated quite a few pieces in this manner, always with the best results. So far I have not been able to detect any after effects and have been able to find no deterioration due to chemical action from the ammonia.

EDWIN L. POWELL.

Questions and Answers in Wireless

By A. B. COLE

50.—My ground connection is made to the brass of a combination gas and electric light fixture. Why can I not receive loud signals?

The metal of such a fixture is insulated from the gas pipe by means of an insulating joint, which is required by the Fire Underwriters. In order to obtain a good ground connection it will be necessary for you to connect the ground wire to the gas pipe itself.

51.—Will an aerial supported by a kite give good results?

Kites have been used for this purpose, and a notable example is the long distance experiment of the old De Forest Company in 1907, when one thousand words were sent from the Manhattan Beach (N. Y.) station, to a station on the west coast of Ireland. At the latter station the aerial was supported by kites. It was reported at the time that about 500 words of the message were received, and this was considered a great achievement then.

The box kite is one of the best for this purpose, on account of its steady and strong pull in a good breeze. Kites are seldom used, however, except in experimental work, since the rising and falling motion varies the position of the aerial with respect to the earth, and consequently varies its capacity. This variation makes tuning difficult.

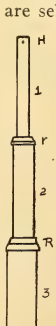


FIG. 17

52.—Give dimensions and description of a 30 foot iron pole for supporting the aerial.

A metal pole is to be recommended for amateur work, for it is inexpensive, durable, and easy to construct. A 30 foot pole may be made of water pipe, of the grade known as "heavy," and the method of joining the three sections is given in Fig. 17. Section (1) is a ten foot length of two inch pipe. (R) represents a reducing coupling, known as a 2 by 1¼ inch reducer. Section (2) is a ten foot length

of 1¼ inch pipe, section (3) is a ten foot length of ¾ inch pipe, and (H) is a 1¼ by ¾ inch reducer. The reducers should all be of malleable iron. The sections are held together by the reducers, into which they should be tightly screwed, and the pole and reducers should then be covered with two or three coats of waterproof paint. A hole (H), ⅛ inch in diameter, should be drilled near the top of the pole. A piece of heavy wire passes through this hole, and serves to support a pulley. A rope passes through the pulley and in turn supports the spreader of the aerial which may be lowered at any time for repairs.

53.—Give dimensions of a 70 foot iron pole.

This pole may consist of four sections of "extra heavy" iron pipe, as follows: section (1), 25 feet of four inch; section (2), 20 feet of 2½ inch; section (3), 15 feet of 1½ inch; section (4), ten feet of one inch. Reducers join the sections as in the 30 foot pole.

In general, poles should be designed to withstand the most severe storms which ever occur at the place where they are set up, and in this connection it should be remembered that in the winter, when ice forms on the aerial, the pole and aerial have a considerable weight to support in addition to their own.

54.—What is the purpose of a guy wire?

The iron poles described above are not sufficiently strong to stand unsupported. A guy wire (or several of them) is used to balance the strain caused by the wind and the tension of the aerial. Guy wires should be made of a strong material, such as steel or phosphor bronze, and should be so placed with respect to the pole that they resist the wind pressure in every direction. In time the guy wires will stretch, and it becomes necessary to take in the slack. The turnbuckle illustrated in Fig. 18 is a convenient device for this purpose. A turnbuckle should be placed in each guy.

55.—Is it necessary to break each guy wire and insert an insulator?

It is not necessary but desirable. Since these wires are grounded, although possibly indirectly, they act as aerials, absorbing some of the energy which would otherwise be radiated or received, and they are therefore a source of loss,

FIG. 18—TURNBUCKLE

reducing the operating distance. It is possible to draw sparks of considerable length from the guys of large stations, showing that much energy may be absorbed. If the guys are broken by insulators, however, there is little loss from this cause.

DETECTORS, POTENTIOMETERS AND RECEIVERS.

56. What is the purpose of a detector?

The oscillations set up in the aerial when it is struck by electro-magnetic waves will not directly operate a relay or produce sound in the telephone receivers. An intermediate device, generally known as a detector, is necessary to convert the high frequency oscillations into a form of electrical energy which will serve this purpose.

57. Name the general types of detectors.

Rectifiers; electrolytic; imperfect contact; magnetic.

58. What is the generally accepted theory of the action of rectifying detectors?

The oscillations produced in the aerial system somewhat resemble alternating currents used for electric lighting, especially when the station is one of a system operating with slightly damped waves. Rectifying detectors seem to have the peculiar property of acting as electric valves, cutting off the oscillatory currents as they flow in one direction and allowing them to pass as they flow in the other direction. Probably this effect is due to the heating of the two materials

of the detector at the point of contact, at which, although it is claimed there is a "perfect contact," there is undoubtedly far from a perfect electrical contact. Detectors of this type require no battery in series with the telephone receivers.

59. Name the most sensitive rectifying detectors.

Perikon; silicon; carborundum; ferron or pyron; molybdenite; audion.

60. Describe these detectors.

A perikon detector consists of a stand having two metal cups holding the sensitive materials, and so arranged that the points of contact between the materials and the pressure of one on the other may be changed at will. A spiral spring contained in one of the tubes supporting the cups is employed to give the required pressure. The essential material of the perikon detector is zincite, which is an oxide of zinc, and is chemically known as ZnO. Various materials have been used in combination with zincite, such as chalcopyrite, bornite, galena, carbon, brass and others. One of the most sensitive combinations which the author has had occasion to use is that of zincite with silver or gold telluride, or metallic tellurium.

The perikon detector is very satisfactory for most purposes, and many are in use by the army and navy.

A silicon detector consists of a metal rod, terminating in a point at the lower end, and so arranged that the pressure upon a small piece of silicon may be varied. The silicon is often held in a metal cup by means of solder or other readily fusible metal. A spiral spring in the vertical tube furnishes the pressure of the metal point on the silicon.

Silicon is a product of the electric furnace, and is made in several grades, whose compositions vary from a small percentage of silicon to as high as 98 per cent silicon. The lower grades are not nearly so sensitive as the higher grades.

The low cost of making this detector its reliability, ease of adjustment, and sensitive qualities, make it the general favorite of amateurs and operators. No local battery is needed with this detector or with perikon.

A carborundum detector may be made from a silicon detector by substituting carborundum for the silicon. Some pieces of carborundum are more sensitive than others, and this is probably due to the fact that at different parts of the furnace the temperature is different, and possibly compounds of various compositions result.

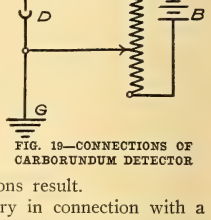


FIG. 19—CONNECTIONS OF CARBORUNDUM DETECTOR

A local battery in connection with a potentiometer should be used with a carborundum detector. Two or three dry cells may be required, depending on the kind of carborundum used. This is a very satisfactory detector, and is extremely sensitive when a good crystal is used. The green variety of carborundum generally gives very good results. Fig. 19 shows how the carborundum detector may be connected to (L) the lead-in wire from the aerial, (T) a telephone receiver, (P) a potentiometer, and (B) a battery.

The sensitive material of the ferron, or pyron, detector is iron pyrites, sometimes known as "Fool's Gold." This occurs in Nature in large quantities. Unlike silicon, iron pyrites is not equally sensitive at all points on its surface.

This material may be used in the same type of detector stand as silicon, and when the metal point rests on one of the sensitive points, the ferron detector is very sensitive. It is practically unaffected by static. No local battery is needed with this detector.

A molybdenite detector may be made from a silicon detector by substituting a thin piece of molybdenite for the silicon. For best results considerable pres-

sure of the metal point on the molybdenite is required. No local battery is needed for this detector. It is little affected by static, and by proximity to the spark gap, and is not so sensitive as silicon or carborundum.

Directory of Wireless Clubs

This directory of amateur wireless clubs and associations will be published each month. When a new club is formed the names of the officers, also the street address of the secretary, should be forwarded to us at once. Any changes that should be made in the directory, when designated by an official of a club, will be made in the next issue after receipt of such advice.

Aero Wireless Club.—A. Garland, President; W. Ladley, Vice President; D. Beard, Napa, Calif., Secretary and treasurer.

Allegheny County (Pa.) Wireless Association.—Arthur O. Davis, President; Theodore D. Richards, Vice President; James Seaman, Leetsdale, Pa., Secretary and Treasurer.

Alpha Wireless Association.—L. L. Martin, President; F. A. Schaeffer, Vice President; G. F. Girton, Box 57, Valparaiso, Ind., Secretary and Treasurer.

Amateur Wireless Association of Schenectady, N. Y.—D. F. Crawford, President; L. Beebe, Vice President; C. Wright, Treasurer; L. S. Uphoff, 122 Ave. "B," Schenectady, N. Y., Secretary.

Amateur Wireless Club of Geneva (N. Y.).—R. B. Graves, Jr., President; C. Hartman, Vice President; L. Reid, Treasurer; Benj. Merry, 148 William St., Geneva, N. Y., Secretary.

Berkshire Wireless Club.—Warren A. Ford, President; William Yarkee, Vice President; Charles Hodecker, Treasurer; Jas. H. Ferguson, 18 Dean St., Adams, Mass., Secretary.

Canadian Central Wireless Club.—Alexander Polson, President; Stuart Scorer, Vice President; Benj. Lazarus, P. O. Box 1115, Winnipeg, Manitoba, Can., Secretary and Treasurer.

Cardinal Wireless Club.—K. Walthers, President; F. Dannenfelser, Vice President; Miss A. Peterson, South Division High School, Milwaukee, Wis., Secretary.

Chicago Wireless Association.—John Walters, Jr., President; E. J. Stien, Vice President; C. Stone, Treasurer; F. D. Northland, Secretary; R. P. Bradley, 4418 South Wabash Ave., Chicago, Ill., Corresponding Secretary.

Fargo Wireless Association.—Kenneth Hance, President; John Bathrick, Vice President; Earl C. Reineke, 518 9th St., Fargo, N. D., Secretary.

Forest Park School Wireless Club—W. S. Robinson, Jr., President; William Crawford, R. F. D. No. 1, Springfield, Mass., Secretary.

Frontier Wireless Club.—Chas. B. Coxhead, President; John D. Camp, Vice President; Franklin J. Kidd, Jr., Treasurer; Herbert M. Graves, 458 Potomac Ave., Buffalo, N. Y., Secretary.

Gramercy Wireless Club—J. F. Diehl, President; H. Green, Vice President; J. Gebhard, Treasurer; J. Platt, 311 East 23d St., New York, N. Y., Secretary.

Northwestern Wireless Association of Chicago—Rolf Rolfson, President; H. Kunde, Treasurer; Edw. G. Egloff, 2729 Noble Ave., Chicago, Ill., Recording Secretary.

Hannibal (Mo.) Amateur Wireless Club.—Charles A. Cruickshank, President; J. C. Rowland, Vice President; William Youse, Treasurer; G. G. Owens, 1306 Hill St., Hannibal, Mo., Secretary.

Haverhill (Mass.) Wireless Association—Riedel G. Sprague, President; Charles Farrington, Vice President; Leon R. Westbrook, Haverhill, Mass., Secretary and Treasurer.

Independence Wireless Association.—Boyce Miller, President; Ralph Elliott, Secretary; Joseph Mahan, 214 South Sixth St., Independence, Kan., Vice President.

Jonesville Wireless Association.—Frederic Wetmore, President; Webb Virmylia, Vice President; Richard Hawkins, Treasurer; Merritt Green, Lock Box 82, Jonesville, Mich., Secretary.

Long Beach Radio Research Club.—Bernard Williams, 555 E. Seaside Bvd., Long Beach, Calif., Secretary.

Manchester, (N. H.) Radio Club.—Homer B. Lincoln, President; Clarence Campbell, Vice President; Elmer Cutts, Treasurer; Earle Freeman, 759 Pine St., Manchester, N. H., Secretary.

New Haven Wireless Association.—Roy E. Wilmot, President; Arthur P. Seeley, Vice President; Russell O'Connor, 27 Vernon St., New Haven, Conn., Secretary and Treasurer.

Oakland Wireless Club.—H. Montag, President; W. L. Walker, Treasurer; W. R. Sibbert, 916 Chester St., Oakland, Calif., Secretary.

Oregon State Wireless Association.—Charles Austin, President; Joyce Kelly, Recording Secretary; Edward Murray, Sargeant-at-Arms; Clarence Bischoff, Lents, Ore., Treasurer and Corresponding Secretary.

Pacific States Wireless Association.—Howard W. Lewis, President; W. N. Hickman, Vice President; Earl C. Hanson, Recording Secretary; Stanley McClatchie, 288 Wilcox Ave., Los Angeles, Cal., Corresponding Secretary.

Peterboro Wireless Club.—G. B. Powell, President; C. V. Miller, Vice President; E. W. Oke, 263 Engleburn Ave., Peterboro, Ontario, Can., Secretary and Treasurer.

Plaza Wireless Club.—Paul Elliott, President; Myron Hanover, 156 E. 66th St., New York, N. Y., Secretary and Treasurer.

Rockland County (N. Y.) Wireless Association.—W. F. Crosby, President; Tracey Sherman, Vice President; Marquis Bryant, Secretary; Erskine Van Houten, 24 In Pew Ave., Nyack, N. Y., Corresponding Secretary.

Roslindale (Mass.) Wireless Association.—O. Gilus, President; E. T. McKay, Treasurer; Fred C. Fruth, 962 South St., Roslindale, Mass., Secretary.

Sacramento Wireless Signal Club.—E. Rackliff, President; J. Murray, Vice President; G. Banyard, Treasurer; W. E. Totten, 1524 "M" St., Sacramento, Calif., Secretary.

Southern Wireless Association.—B. Oppenheim, President; P. Gernsbacher, 1435 Henry Clay Ave., New Orleans, La., Secretary and Treasurer.

Springfield (Mass.) Wireless Association.—A. C. Gravel, President; C. K. Seely, Vice President and Treasurer; D. W. Martenson, Secretary; Club Rooms, 323 King St., Springfield, Mass.

St. Paul Wireless Club.—Thos. Taylor, President; L. R. Moore, Vice President; E. C. Estes, Treasurer; R. H. Milton, 217 Dayton Ave., St. Paul, Minn., Secretary.

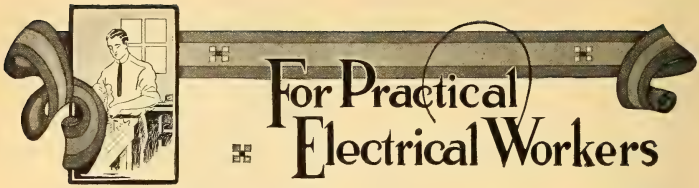
Tri-State Wireless Association.—C. B. DeLa-Hunt, President; O. F. Lyons, Vice President; T. J. M. Daly, Treasurer; C. J. Cowan, Memphis, Tenn., Secretary.

Wireless Association of British Columbia.—Clifford C. Watson, President; J. Arnott, Vice President; E. Kelly, Treasurer; H. J. Bethel, 300 Fourteenth Ave. E., Vancouver, B. C., Corresponding Secretary.

Wireless Association of Canada.—W. Fowler, President; E. G. Lunn, Vice President; W. C. Schuur, Secretary and Treasurer.

Wireless Association of Montana. Roy Tysel, President; Elliot Gillie, Vice President; Harold Salter, 309 South Ohio St., Butte, Mont., Secretary.

Wireless Club of Baltimore.—Harry Richards, President; William Pules, Vice President; Curtis Garret, Treasurer; Winters Jones, 728 North Monroe St. Baltimore, Md., Secretary.



Householders, Know Your Meter

By GUY R. GROVE

The little electric meter tells you each month just how much you have to turn over to the electric light company. It is a silent salesman and its accuracy is just as important as that of the scales used in public markets for weighing goods sold over the counter to the buying public. But not one in a hundred has any idea of what the inside of a meter looks like. The principle of the meter and its operation is a complete mystery to the majority of electric light consumers. It is this ignorance that leads to the general doubt of the public as to its accuracy in measuring electrical energy. However, in the face of all this doubt it can be proven that the modern meter is one of the most accurate measuring devices made.

Public service commissioners and civic committees which several of the states now have for regulating the prices and methods of selling commodities to the public have investigated the usual methods and practices of weighing and measuring and have found more need of improvement in other methods than has been necessary in the approved and modern methods of metering electricity. Instruments for measuring electrical units are accepted as being among the most accurate instruments known and the modern electric meter is indeed an instrument of precision when compared with the instruments, apparatus and means of measuring many other commodities. In order to insure that the meters may be maintained so as to operate with the highest degree of accuracy many of the lighting companies maintain a regular meter testing department, equipped with the most accurate standards obtainable.

The meter is a miniature electric motor of very delicate construction. It is so connected in the circuit that the current used in the circuit on which it is connected will flow through the meter, which causes it to run and consequently to register in direct proportion to the quantity of current flowing through it.

The watt is the practical unit of electrical measurement, the same as the pound is the unit of weight, and is equivalent to 1-746 of a horsepower. When a watt is used continually for one hour it is called a watt hour. As the watt hour is too small for a commercial unit of measurement the term kilowatt hour, meaning 1,000 watt hours, is commercially used. The term is usually abbreviated K.W.H. and all electrical rates and bills are based on the K.W.H. as a unit. For instance, when electrical energy is sold at ten cents it means ten cents per K.W.H., or ten cents for the use of 1,000 watts for one hour, or 500 watts for two hours. To get a better idea of how much a K.W.H. is we can compare it with an ordinary sixteen candlepower carbon lamp. If such a lamp is burned one hour it will consume 50 watt

hours, or 1-20 of one K.W.H., and would have to burn 20 hours before the meter would register one K.W.H. People often get the mistaken idea that they can use a 50 or 60 watt lamp for any length of time and only consume 50 or 60 watts. They do not take into consideration the time element, and instead of using a total of 50 watt hours they use 50 watt hours for each full hour they use the lamp.

On account of the extremely delicate construction of electric meters they have a general tendency to run slow rather than fast, due to the friction of the bearings. They seldom run fast unless subject to abnormal conditions. In fact, the First District of New York Public Service Commission has found that of meters tested during a recent period, 92.4 per cent were registering accurately, 5.8 per cent slow and 1.8 per cent fast.

In states which have a commission as mentioned above, the commission will test any meter on request of the consumer with the understanding that if the meter is running fast and to the detriment of the consumer the lighting company shall pay for the expense of the test; if the meter is found to be correct or running slow the consumer is required to pay the expense of the test. The expenses of these tests range from $2 to $10, depending on the size of the meter.

The report of one of these commissions showed that on these tests 90.5 per cent were correct, 8.2 per cent slow and 1.3 per cent were running fast. This shows that in this particular report that 98.7 per cent of the parties making the complaint paid for the expense of the test.

Meters rarely run over ten per cent fast if they run fast at all. Half of the people who have occasion to complain, or at least think they have, to the electric light office remark that their meter is running twice as fast as it should. This is a mistaken idea, as it is practically impossible for a meter to do so. Of course there are times when the meter shows a consumption twice as large as previous months but in 99 cases in 100 it is no defect in the meter. The current is going through the meter but is in most cases used by a "ground" or by lights burned in the house that the one complaining knows nothing about. Such complaints are given close attention by the company and the meter is tested.

Light users who have cause to suspect that their meter is running fast can make a rough test and satisfy themselves as to how it is running. This is done by reading the meter and keeping a record for a few days of the exact time the lights are used. In doing this a close tab must be kept of all lights burned and count all used even if only in use for ten or fifteen minutes at a time. The watts consumed by gem and tungsten lamps are marked on the bulbs, as they are rated in watts. Carbon lamps are rated in candlepower and the wattage is not always given on the bulb. However, following is the relative consumption:

4 candlepower carbon lamp— 20 watts
8 candlepower carbon lamp— 30 watts
16 candlepower carbon lamp— 50 watts
32 candlepower carbon lamp—100 watts

A reading of the meter should be taken before and after the test and the consumption shown on the meter compared with the K.W. hours shown on the tab record. If this is done and close tab kept of all lights used it will be surprising to find that light is used that had not been thought of before, the meter accurately recording the current all the time.

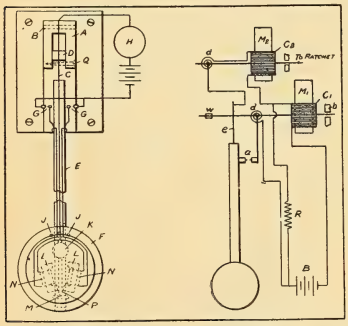
Using Old Carbon Ends

Instead of consigning old arc lamp carbon ends to the scrap pile they may be employed to advantage in connection with lightning conductor work. Because of the higher conductivity of pure carbon compared with coke, the unconsumed pieces of arc lamp carbons make an excellent bed for ground plates in the earth.

How an Electrical Clock Operates

In this article is presented a diagrammatic arrangement of the various parts of an electric master clock without giving dimensions and details. With a clear idea of the way such a clock operates the amateur should be able to build to suit his fancy as to size and materials available.

The first design, Fig. 1, is especially interesting from the fact that the greater



FIGS. 1 AND 2. PRINCIPLE OF ELECTRIC CLOCK

part of the operating mechanism is placed on the pendulum bob. By arranging small electro-magnets behind the bob in such a manner that a weight is drawn over to the high side of the bob at the end of each stroke, this weight is made to drive the pendulum. Such an action as this can be easily illustrated by watching a boy in a rope swing. At the end of each oscillation he quickly shifts the center of gravity of the swing and himself and gets the desired push.

Such a mechanism is shown in Fig. 1 in which (F) is the pendulum bob suspended by rod (E). Behind the bob are mounted the parts shown by dotted lines. (K) is a small weight mounted on an iron rod (P), and arranged to work on a knife edge (M). (LL) are the electro-magnets with coil (N) placed as shown, and connected to battery through the contact points (GG). (H) is a pull up mechanism to register the time and consists of a simple ratchet wheel which is moved one tooth at a time by means of an electro-magnet. The wheel train may be taken from an old alarm clock, together with the hands and dial.

The bob is suspended by means of a steel spring (C) held in the head block by means of pin (B). A split block (D) is free to slide up or down (in recess shown) when screw (Q) is loosened. In this manner the length of the pendulum may be changed and the clock regulated. Contact points at (G) are made of platinum. The circuit shown by light lines is run on the back side of the pendulum. The middle or common wire is fastened directly to (C), as shown. When (K) is pulled over by either of the electromagnets (L), it moves far enough to remain against the stop (J) without the aid of any fastening devices. This reduces the mechanism as a whole to the pendulum and one moving part.

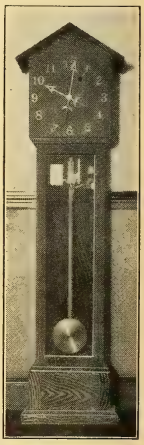


FIG. 3. ELECTRIC CLOCK

The pendulum bob is made of lead cast in a pie tin and suspended by means of a spruce rod. The bob weighs 22 pounds. The weight of (K) and (P) together is seven ounces. (P) is made of iron ¼ inch square. This clock requires two gravity cells for operation. Its time keeping qualities are not independent of battery strength but so nearly so that when used on gravity cells it keeps very good time.

A design was furnished to a Y.M.C.A. class in practical electricity (of which the writer was instructor), and a clock

was constructed by them for the city Y.M.C.A. of Lafayette, Indiana. This clock, the cut and circuits of which are shown in Figs. 2 and 3, is still in operation.

Referring to Fig. 2, it will be seen that when the pendulum is swung to the right, electrical contact is completed through the platinum points at (a). Coil (C), which is connected into the circuit by these points, holds two windings, one of which is energized at all times as can be seen from the diagram. This winding tends to hold the coil in the "up position" against the stop (b) by reaction with the field of the permanent magnet (M1). The other winding when energized by closing contacts (a), sets up a field equal and opposite to that of the first winding, and coil (C1) falls of its own weight and gives just enough push on the pendulum at (a) to keep it in motion.

The hands and wheel train (taken from an old clock) are driven by coil (C2), which is impelled upward by the reaction of its field with that of (M2), a permanent magnet, each time the pendulum makes contact at (a).

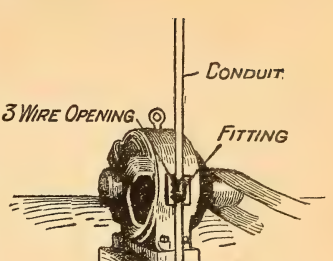
Electrical connections are made to moving arms through hair springs (d). A resistance (R) is inserted in the closed circuit to balance the resistance of (C2).

Since it is the force produced by the weight of coil (C1) dropping which drives the pendulum, this clock operates independently of battery strength and has been regulated to keep time within 20 seconds per month.

CHARLES B. MOORE.

A "Good Ending" in Conduit

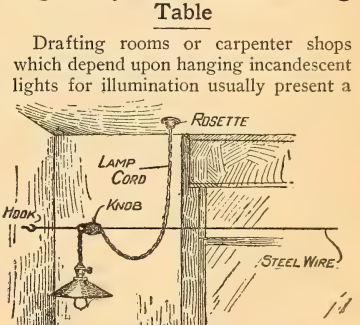
The illustration shows a much better method for ending conduit at motor terminal blocks when the conduit is run on the ceiling than is generally the case. Instead of ending in an outlet box at the terminal block, and being left to be pushed this way and that, a "T" fitting is used, having a three wire opening, from which the pipe is continued until it rests upon the floor, where it is fastened, thus affording a rigid support, and when the motor foundation will permit, it can be fastened to it with pipe straps.



METHOD OF ENDING CONDUIT AT MOTOR TERMINALS

Light Adjuster for the Drafting Table

Drafting rooms or carpenter shops which depend upon hanging incandescent lights for illumination usually present a tangled up appearance as to lamp cords, as each man twists and ties the cord to suit his particular needs, which may vary five or six times a day.

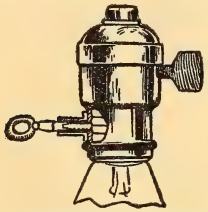


LIGHT ADJUSTER

By stringing porcelain knobs on No. 16 steel wire stretched across the bench or table and securing the flexible lamp cord to it by tape the lamp may be readily moved along to any point needed.

Locks Lamp in Socket

There have been devices on the market in the past, designed to accomplish this purpose, but the theft of lamps and shades was not prevented because the



LAMP SOCKET WITH LOCK

design was such that the socket could be opened by a hair-pin, toothpick or match.

If the socket is equipped with P. & S. Shurlok locking attachment, there is no possible way in which the lamp may be taken from the socket without the use of the key.

A Simple Flasher

The electric sign business of today is perhaps the most spectacular phase of electrical work. The degree of perfection reached and the artistic effects produced are truly wonderful. In every place of any size many and intricate designs are displayed and the average person little thinks how they are produced.

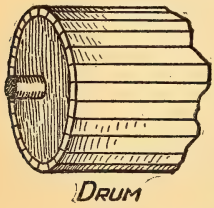


FIG. 1

The general principle is simple and can be carried out on a limited scale by almost anyone, with a little careful work. On a recent occasion a very simple flasher was built and it aroused so much interest that the diagram and description are given below:

A small wooden drum, Fig 1, about 2¾ inches in diameter is the most convenient size to use. A hole should be bored through it and a shaft of metal fitted. Upon the wooden cylinder ⅜ inch asbestos board should be placed in strips so as to entirely cover the wood. These strips should be held in place by countersunk screws. Supports can then be made and the drum should rotate

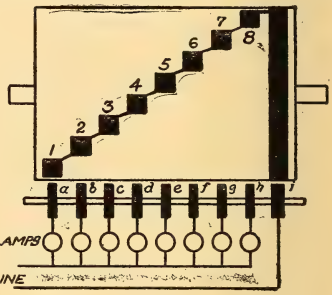


FIG. 2

freely. A crank can be attached for hand operation or a pulley if it is desired to belt it to a small motor.

Take eight small squares or strips of copper or brass and fasten them to the drum as shown in Fig. 2. (1, 2, etc.) One strip should extend around the entire circumference. Each piece should be connected to the next one as shown. The sketch shows the drum "flattened out" so as to be more easily understood. Light sheet copper or brass is the most suitable material.

Next contactors should be provided as shown (a, b, etc.). These may also be made of brass or copper and should be slotted and then screwed to an asbestos board support. The slot will allow some adjustment of pressure between the contactors and strips on the drum.

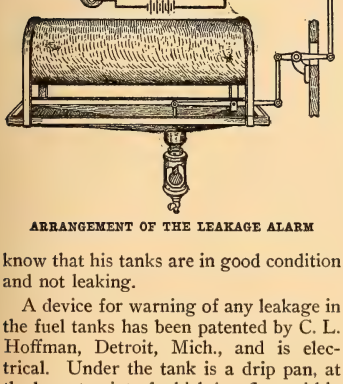
The lamps should be connected as in the diagram, Fig. 2, one side of each lamp to the contactors and the other ends connected to a common point. This common point is then connected to the line.

The other side of the line should be connected to the contactor pressing on the ring on the drum. As the drum is rotated the contactors make the circuit through the strips in the drum and thus the current flows through the lamps. One lamp goes out before the next comes on and thus a flashing effect of the lamps is produced.

If more than one lamp is to be used per contact they should be connected across the same points as the one lamp shown and heavier conductors should be used. Some arcing may result from the breaking of the current, but it will not be enough to be injurious.

Leakage Alarm for Boats

Motor boats are largely operated by gasoline carried in tanks, and it is quite an advantage for the boat operator to



ARRANGEMENT OF THE LEAKAGE ALARM

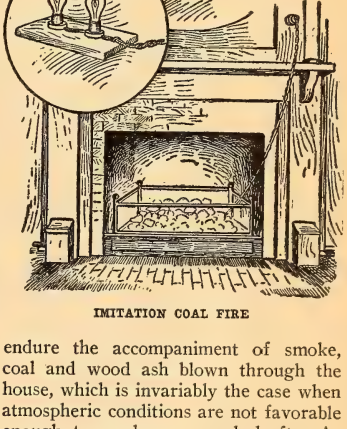
know that his tanks are in good condition and not leaking.

A device for warning of any leakage in the fuel tanks has been patented by C. L. Hoffman, Detroit, Mich., and is electrical. Under the tank is a drip pan, at the lowest point of which is a float within a small basin. The float is attached to a stem and levers so that a switch closes the circuit on an annunciator as soon as oil enters the basin and causes the float to rise.

An Imitation Coal Fire

Open fireplaces used as a means for heating houses are not to be compared with the more efficient methods of the present day, yet the open fire is gaining rapidly in favor.

This must be for reasons of sentiment alone, which are strong enough to



IMITATION COAL FIRE

endure the accompaniment of smoke, coal and wood ash blown through the house, which is invariably the case when atmospheric conditions are not favorable enough to produce a good draft. As the cheery effect of the fire seems to be what is desired rather than the warmth, this effect can be attained by means of colored electric lamps without any of the disadvantages incurred in using coal.

Two lamp sockets are secured to a shallow oblong metal box fastened to the inside of the back of the grate and arranged to be connected to a lamp socket in the room by an extension cord and attachment plug. The glow of the burning red lamps shining through a mixture of broken pieces of thick glass, red and amber isinglass and a few coals scattered over the top, produces a very realistic and pleasing effect.

H. G. Wilson.

Reversing Switch

The illustration, Fig. 1, shows an easily constructed switch for reversing small motors, changing the polarity of electro-magnets, etc.

The vertical section of wood (A) is mounted on a base (B) which also carries the four binding posts (C, D, E, F). Three copper segments (G, H, I) are

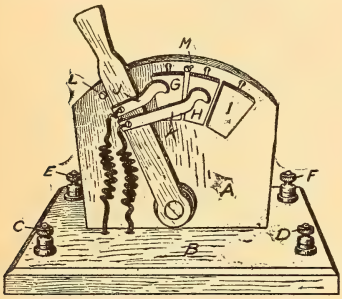


FIG. 1. SIMPLE REVERSING SWITCH

mounted closely together on the section (A). Segments (G) and (I) are both connected to the binding post (F) while the middle one (H) is connected

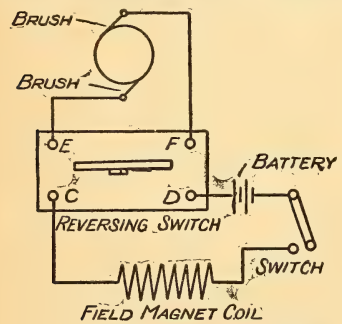


FIG. 2. CONNECTIONS OF REVERSING SWITCH

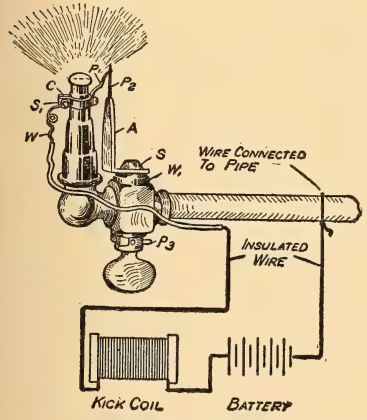
to binding post (E). A thin wood lever carrying the copper brushes (J, K) is mounted on the piece (A) with a screw, a washer being placed between the two to separate them enough to allow the lever to clear the segments (G, H, I) in passing over. Brush (J) is connected with binding post (C) and brush (K) to binding post (D) using coiled wires to allow free movement of the lever. Brush (J) must be just long enough to make contact with segment (G) when (K) touches (H). Moving the lever to the right brings brush (J) in connection with (H) and brush (K) with (I), thus reversing the current. Brads (L) and (M) may be used to stop the lever at the correct points. Fig. 2 shows connection for reversing a battery motor. When so connected the current will be reversed in the armature but not in the field magnet coil.—L. A. KING.

How to Make an Electric Gas Lighter

A very simple and inexpensive electric gas lighter can be made as follows: Obtain a valve and tip similar to the one shown in the accompanying figure. Remove the screw (S) and the washer (W_1), and provide a piece of 1/16 inch brass about 2¾ inches long, ½ inch wide at one end and ⅛ inch wide at the other end. Solder the washer to the large end of this 1/16 inch piece, drill a hole for the screw (S) and round the end of the piece to correspond to the washer. The 1/16 inch piece should now be bent as shown in the figure, so that the vertical portion stands about ¼ inch from the vertical pipe. Now make a collar (C) from some thin brass and clamp it to the pipe by means of a screw (S_1). This collar must be insulated from the pipe by a thin sheet of asbestos or mica. Obtain two short pieces of platinum, (P_1) and (P_2), from an old Edison incandescent lamp and mount them as shown in the figure. The upper end of the arm (A) must be cut to the proper length before the piece of plantinum (P_2) is fastened to it. An additional pin (P_3) should be placed in the

valve so that it can be turned through an angle of only 90 degrees. The platinum points (P_1) and (P_2) should be adjusted so that they break contact just before the valve reaches its full on position.

A spark will be formed when the platinum points break contact, if one terminal of a battery be connected to the pipe itself and the other terminal to the

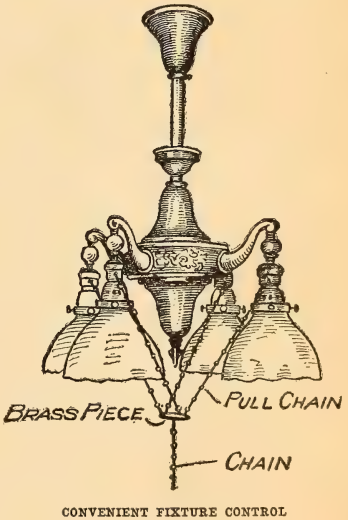


ELECTRIC GAS LIGHTER

collar (C). The insulated wire (W) affords a means of connecting one terminal of the battery to the collar. The spark that will be produced by simply breaking a battery circuit may not always be of sufficient intensity to ignite the gas. This difficulty can be overcome by placing a "kick coil" in the circuit. The kick coil is nothing more than a coil of wire of low resistance about a soft iron core and one may be constructed as follows: Obtain a small quantity of soft iron wire, about No. 20, and cut a sufficient number of pieces, eight inches long, to make a core ⅞ inch in diameter. Wind five layers of No. 18 B. & S. gauge double cotton covered wire on this core, insulating the winding from the core and the various layers from each other. Connect this coil in series with six dry cells and the spark produced when the circuit is broken will be ample to ignite the gas. The adjustment of the contacts (P_1P_2) should be such that the circuit is closed some little time before it is broken. David P. Moreton.

Convenient Fixture Control

A cheap and easily installed device for controlling the lamps in a fixture makes use of the chain pull socket. An extra long chain is connected to each socket, with the free ends connected to a small circular piece of brass about the



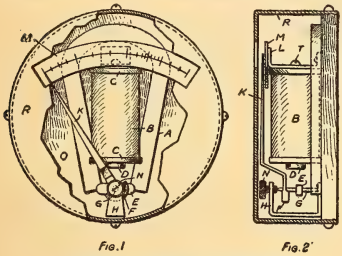
CONVENIENT FIXTURE CONTROL

size of a half dollar, and from its center is hung another piece of chain as long as may be necessary for convenient hand reach. A straight pull on the central chain will turn on or off all the lights, and any one of the lights may be controlled by a side pull opposite in direction to the side on which the socket is hung.

A Pocket Storage Battery Voltmeter

One of the most convenient and accurate methods of determining the condition of a storage cell is a reliable, low reading pocket voltmeter. Fig. 1 is a plan view and Fig. 2 is a side view of an easily constructed instrument.

For the circular base (O) use hard rubber or fiber not less than 3-16 inch in



STORAGE BATTERY VOLTMETER

thickness. Fastened in the position shown is a small 1½ inch to 2 inch horseshoe magnet. Select a rather heavy magnet with poles not too close together. It should be of the best quality as the cheap toy magnets will usually lose most of their magnetism in a short time. Brass straps with small screws are used for fastening it to the base.

For the pivot (G) of the moving system, break off both ends of a large sewing needle, leaving the center portion about ½ inch long and then grind both its ends to sharp points. The armature (E) is about ⅛ by 3/32 by ⅜ inch, with ends neatly rounded. This must be of hard tempered steel and strongly magnetized. Soldered near the top of the pivot at the proper angle is the pointer (K), made of very thin springy brass nicely tapered and blackened. The counterbalance (F) is very important. It must exactly balance the pointer and also any inequalities in the balance of the armature. The various parts should retain the positions shown (Fig. 1), unless deflected by a current, no matter in what position the instrument is placed.

The support for the bearings of the moving system is the U-shaped brass piece (H). The lower bearing is a cone-shaped hole only part way through the piece itself, while the upper bearing is a similar hole in the end of the adjusting screw (N).

The coil (B) is composed of a soft iron core (D) about 3/16 inch in diameter. One end is bored and tapped to take a small machine screw (T). Two fiber heads (CC) are placed in position, the core insulated and then wound with No. 32 to 34 magnet wire. A few trials may be necessary to obtain the right amount of wire to produce the correct deflection. It is impossible to give exact data owing to the difference in friction in each instrument.

The completed magnet is supported by the brass piece (L), one end of which is bent over to form a support for the scale. The end of core (D) should be in such a position that when the armature is drawn around at right angles to its position in the figure there will be about 1/32 inch between them.

The scale (M) may be of heavy cardboard or better of 1/16 inch fiber with white paper pasted over it.

A good case (R) may be made of 1/32 inch brass bent into a cylinder with a diameter the same as that of the base. A brass cover with the portion over the scale cut away is soldered in one end of this cylinder. The other end is fitted over the base and held there by screws.

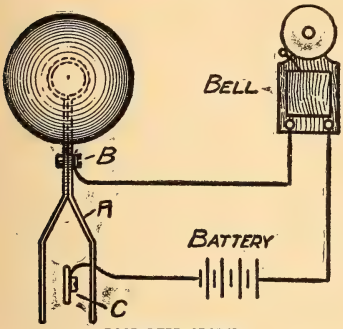
The instrument is now connected in parallel with a standard low reading voltmeter. The portion of the scale from 1.75 to 2.25 should be marked in very fine divisions.

The terminals of the coil (B) should be run to two convenient insulated binding posts (not shown) on the side of the case.

Either wood screws or machine screws may be used to fasten parts to the hard rubber. JAMES P. LEWIS.

A Simple Door Bell Alarm

An easily made switch for ringing a bell to let me know when anyone opened the door of my shop is here described.



DOOR BELL ALARM

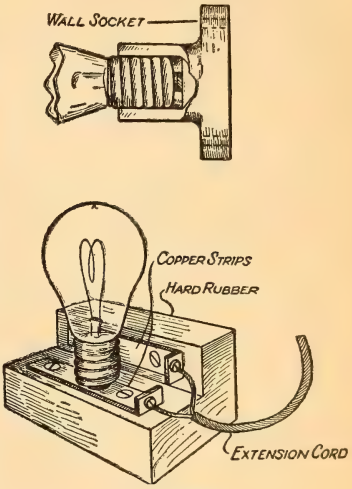
A metal strip (A) preferably of copper should be bent into a small circle at the middle to fit over the door knob bar. A small bolt will draw it up tight around this bar at (B). Place between the prongs and fastened to the door a metal strip (C) and the device is complete. By connecting a battery and bell as shown a slight turn of the knob either way will throw one prong or the other against (C) completing the circuit and ringing the bell. EBEN EDMONDS.

Time Savers in Testing Lamps

In factories and shops where many incandescent lamps are used or where lamps are packed for shipment, each lamp is usually tested before being placed in service or packed. To save time the devices illustrated are used, thus eliminating the turning of the lamps one by one into a socket to test.

The first device is made by removing the screw shell from a wall socket and hammering out the threads on a 5/8 inch pipe. The shell is then replaced. Lamps may now be slid into the socket and tested at a rapid rate.

The second device may be made from a hard rubber block shaped as shown. Two copper strips placed on the two faces of the block and connected to the

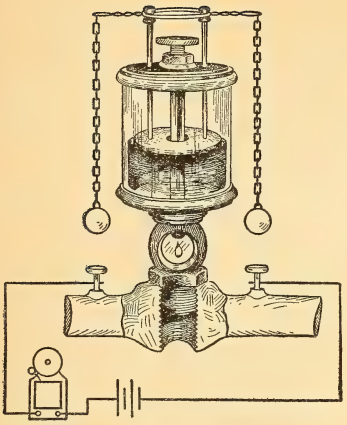


LAMP TESTERS

lighting circuit complete the outfit. The illustration makes plain the position of a lamp when tested.

When the Oil Cup Is Empty

The prevention of hot bearings is always a pertinent theme among engineers and different schemes have been presented to prevent these. One arrangement consists of a float which rises and falls with the amount of oil in the oil cup, making and breaking contacts by means of two metal chains and balls, one on either side of the cup and connected together by a ring insulated from the supporting rods. When the oil and float falls to a predetermined point the circuit is closed and an alarm sounds. If a large number of bearings are equipped, they are divided into groups of five or six on a circuit and these circuits are connected



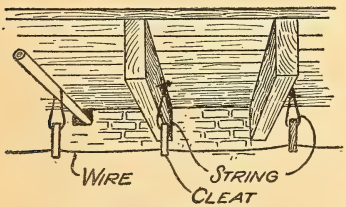
ALARM FOR OIL CUPS

to an annunciator. The circuits all being numbered and their location known, it is but a matter of a few minutes to locate the empty cup when the circuit number falls into view on the annunciator.

H. G. WILSON.

Safe Temporary Wiring

In the rewiring of buildings where it is necessary to have all the lights burning during the alterations, wires are



TEMPORARY WIRING JOB

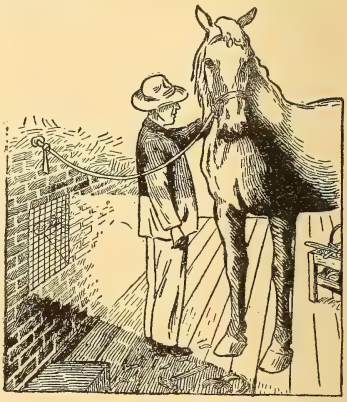
usually strung on or tied around any convenient supports.

A better method is to use cleats, of which there are usually a quantity lying around on jobs of this kind. One of the nail holes in the cleat is used to suspend it vertically by means of a piece of wire or string and the other hole affords a good support for the No. 14 circuit wire which is passed through it. The cleats holding the two circuit wires should be separated about six inches from each other and the distance between supports will vary according to the objects, such as pipes, etc., which may be convenient.

H. G. WILSON.

Light for the Blacksmith

The accompanying illustration shows how an enterprising blacksmith provides illumination in his shop so that the light will fall where most needed. Recesses in the wall contain each an incandescent



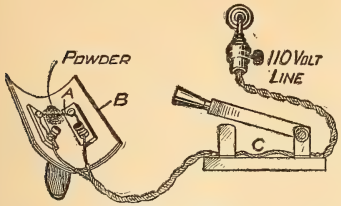
ARRANGEMENT OF BLACKSMITH'S LIGHT

lamp. The wires for these are run in conduit laid in the wall. It was necessary to place a wire netting over the wall recess to keep the horses from biting and breaking the lamps.

Firing Flashlights Electrically

The expression on the faces of a group of people taken by a flashlight is often strained or unnatural because of the suspense in waiting for the flash. The flash set off by electricity avoids this, for

the operator can watch for the proper moment and take them unawares.



FLASHLIGHT DEVICE

An easily made flashlight consists of two copper strips mounted on a piece of curved board (B), covered by a layer of ¼ inch asbestos. Between the strips and fastened by screws is a No. 32 or smaller iron wire (A). A single pole knife switch (C) arranged as shown will enable the operator to include himself in the picture. Although the writer has fired a great many flashlights in this manner with four ampere fuses on the house circuit, the fuses have never blown.

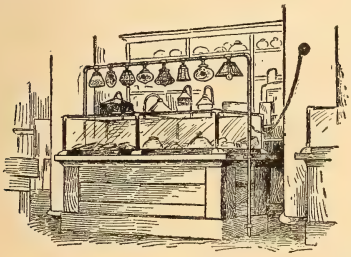
WESLEY G. PAULSON.

Electricity the Silent Salesman

Some helpful hints on the use of electric current in getting up show window displays. The following schemes have all been used with remarkable success.

To Display Shades and Lamps

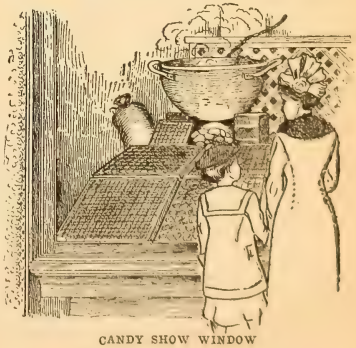
It is always a help for storekeepers who sell electrical goods, to display the electric lamps and fixtures to good advantage, and with the lamps actually burning so as to produce a realistic effect. This scheme here shown is used successfully in the electrical department of a large store. Conduit is installed as illustrated, reaching to about four feet above the show case. It is fastened at the sides of the case and also by the ends at the floor. Outlets are spaced about eight inches apart and from these various types of shades and lamps are suspended and operated.



SHADE AND LAMP DISPLAY

Candy Kettle in Window

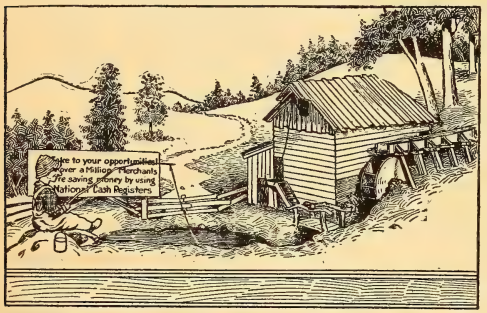
The manager of a confectionary store attracted attention to his product by showing one of the large copper kettles used in candy making. It was placed upon bricks high enough to give room underneath for an imitation fire made by an electric light hidden under pieces of coal and bits of amber and red isinglass scattered over and around the light. Connection was made to a small steam pipe which allowed the steam to rise above the rim of the kettle, thus adding a touch of realism.



CANDY SHOW WINDOW

Fishing in the Old Mill Pond

In a window of one of the National Cash Register Company's offices a novel window display to call attention to a well known make of cash register was set up to represent a rural scene, with



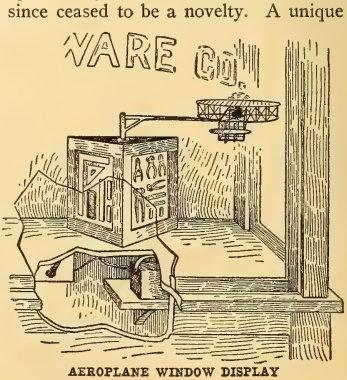
WINDOW DISPLAY THAT ATTRACTS IN SUMMER

a background of woods and fields. In the foreground is an old fashioned mill with a time worn waterwheel turned merrily by water flowing from the stream above. Just below the mill is the pond into which the waste water runs. Besides the pond is a log—the very same log that every man reared in the country will recognize as having sat upon a thousand times—and sitting on the log is a typical country boy, with one suspender and a ragged straw hat, sleepily nodding as he fishes in the mill pond. On the surface the cork is idly floating. As the passer-by stops a moment to look on the peaceful scene, he suddenly sees the cork dip. He's got a nibble! There is another and more vigorous dip, followed by a third more violent still, and one's fingers itch to have hold of that pole! Suddenly with a dart, the cork plunges out of sight—and one looks in disgust to see the fisher boy placidly nodding in slumber! In a few seconds the cork comes to the surface and rests quietly there.

The realistic antics of the cork are the attractive point of this display. They are exactly imitative of cork when a hungry, but wary, fish first nibbles and then takes the bait. These antics are effected by a mechanism which consists of a wheel with irregular teeth which, from time to time, engage a cord attached to the lower end of the cork, and, by pulling it for a long or short time, according to the length of the teeth, simulate the bite of a fish. The final dive of the cork is effected by a tooth of extreme length. The device is operated by an electric motor concealed within the mill and driven by a connection from a wall socket. The mill is about a foot in each dimension and the boy in the foreground about six inches high. The whole display is about five feet long by three deep and is accurately colored to represent appropriately the colors of Nature. It has proved a successful attraction.

Aeroplane Propeller Operates Window Display

The ordinary revolving showcase operated by a concealed motor has long since ceased to be a novelty. A unique



AEROPLANE WINDOW DISPLAY

adaptation of this idea, however, which is sure to attract attention is finding ready favor among hardware and other merchants who desire a rotary display.

The cases of goods or shelves are attached to an accurately mounted tube, at the top of which is fastened an arm carrying a miniature aeroplane and passenger.

The power to revolve the display is obtained from a small motor and propeller mounted in the flying machine. The motor is connected with a storage battery by wires running inside the tube to a commutator at the base. The rate at which the case revolves is regulated by a rheostat placed under the window.

STUART R. WARD.

An Odd Window Light Fixture

A merchant realizing that the stuffed animals in his show windows failed to attract attention after a certain length of time decided to enliven the display with the use of small electric lamps. To each of the tips on the antlers of a stag he fastened with tape small candelabra sockets. These were equipped with lamps having peculiar twisted globes. The necessary fixture wire, being small, was invisible from the street.

THE HORNS WERE TIPPED WITH ELECTRIC LIGHTS

The lamps were connected in multiple and an extension cord with an attachment plug and socket connected to the lighting circuit to provide the necessary current. The scheme was all that could be desired, and succeeded in reviving interest in the display.

Sign for a Restaurant

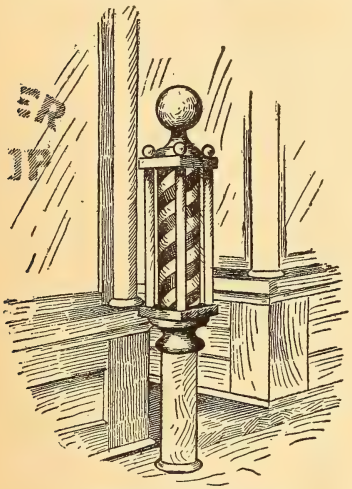
The sign is made in the shape and design shown in order that the impression may be that it is time to eat. The clock face with the lettering should be painted on ground glass. This glass is then placed in a circular box of sufficient depth to permit the introduction of a few incandescent lamps behind the face.

RESTAURANT SIGN

If hung over the sidewalk the ground glass face may be placed on both sides so that one may see it from either direction. The hands may be made of either metal or wood and so arranged that they can be pointed to any desired hour. The hands may, of course, be painted permanently upon the face.

The Rotating Barber Pole

The barber is not behind other shopkeepers in making use of electricity, as is proved by the growing popularity of the revolving barber pole driven by a



THE ROTATING BARBER POLE

motor installed within a supporting pillar. The turning portion is a glass cylinder upon which the stripes are painted and about it is a glass enclosure also in the form of a cylinder. Within the painted cylinder are two incandescent lamps which are used to illuminate the pole at night.

Harmonizing Cord With Window Display

The National Electrical Code rules for wiring require the use of reënforced drop cord for show windows when extension lights, fans and electrical novelties are connected temporarily to the lighting circuits for display purposes. This cord or wire is usually of a dark color which as a rule does not harmonize with the surroundings. To remedy this one store keeper wraps the lamp cord with whatever color of cloth or goods he has on display and in this way the cord goes practically unnoticed and does not detract from the appearance of his goods.

NEW BOOKS

LOW VOLTAGE ELECTRIC LIGHTING. By Norman H. Schneider. New York: Spon and Chamberlain. 1911. 85 pages with 23 illustrations. Price, 25 cents.

The object of this book is to give practical information on small low voltage electric light plants, suitable for farms, isolated houses, stores and country homes in general. Details are given showing how to estimate the size and number of lights required, their best location, the most convenient means of control and the plant necessary to furnish the current.

MODERN AMERICAN TELEPHONY. By Arthur Bessey Smith, Chicago: Frederick J. Drake and Company. 1911. 775 pages with 470 illustrations. Price, $2.00.

The intent of the author of this book is to make it of interest and practical help to the men who "shoot trouble" as well as to those whose duties call them into other relations to a telephone system. A chapter is devoted to wireless telephony and one to the automatic telephone.

THE RAILWAY CONQUEST OF THE WORLD. By Frederick A. Talbot. Philadelphia: J. B. Lippincott Company. 1911. 322 pages with 124 illustrations. Price, $1.50.

This volume is written with the purpose of telling in a popular manner the real romance of great achievements in railroad building. The difficulties and obstacles met in the construction of great railways are described, technical terms are absent and the work is made into a fascinating account of railway history interspersed with stories of adventure and humorous incidents. The illustrations are especially fine.

On Polyphase Subjects

A New Series by Archie Rice

The story of California's achievements in developing hydro-electric power is a long one, but extremely interesting. The first of four popular articles on these wonderful works appears in this issue and the others will follow in issues of the near future. There is probably no writer better equipped to describe to the general, non-technical reader the human interest features of these great plants than the author, Mr. Archie Rice, of San Francisco. The reason that his descriptions impress one so vividly is because he has obtained all his information first hand. A strapping six-footer, and then some, a rough rider and a hardened mountaineer, he has ridden and tramped far back into the mountains where the immense reservoirs, winding flumes and snaky penstocks deliver their thousands upon thousands of horsepower with almost irresistible impact upon the blades of the water turbine generators. It is very seldom that the ordinary tourist invades these remote places.

Mr. Rice, to use his own characterization, was evolved from two generations of Yankee and Southern stock with an Old World backing four-eighths Irish, two-eighths English, one-eighth Scotch and one eighth Dutch. In the early days of large affairs and open country in the San Joaquin Valley his father was called "King of the Plains"—the proven best rough rider in California or Western Mexico.

After his youthful start in the vaquero camps, young Archie discarded his lariat and .44's and made for the world of affairs via the High School and University route, entering Stanford University, as he says, "with its first round-up of 500 students." Four years later, on two rather long, thin-looking legs, he carried away from the campus some fond recollections and an A.B. degree.

Then he entered upon the field of metropolitan journalism and wrote much news matter and embroidered scores of Sunday supplement articles. Just preceding the San Francisco fire he was lured into the life insurance game and a little later, while the city was still smoking, he was a volunteer special policeman with a six-pointed star marking the spot under which beat proudly a half-Irish heart, knowing that it had at last come to its own.

But mostly his livelihood has been gained either by editing magazines and newspapers or by getting material for other editors.

For the personal fun of the thing he has swum three miles at a stretch in the open Pacific and hiked 40 miles through the Sierras, partly over slushy snow, in a day terminated by a rush into camp to devour a shameless meal. It was on such expeditions as the latter that he gathered the material for this series of articles.

Electric Taxis in Berlin

In the city of Berlin there are 2,000 taxicabs, of which 300 are electrics. In order to distinguish the electric cabs from the gasoline it has been prescribed by the police that the electrics shall be painted ivory white, while a brown livery has been ordered for the gasoline operated ones.

Patrick worked for a notoriously stingy boss and lost no chance to let the fact be known. Once a waggish friend, wishing to twit him, remarked:

"Pat, I hear your boss just gave you a brand-new suit of clothes."

"No," said Pat, "only a par-rt of a suit."

"What part?"

"The sleeves iv the vest!"

* * *

"I knew Butts' smoking would get him into trouble."

"Well?"

"At his wedding, when it came to the ring part, he reached into his pocket and handed the minister a match."

* * *

Little Nephew—Auntie, did you marry an Indian?

Aunt—Why do you ask such silly questions, Freddy?

Little Nephew—Well, I saw some scalps on your dressing table.

* * *

"Do you know who her grandfather was? Have you ascertained anything in regard to her pedigree? Those are things you ought to know about the woman you are to make your wife!"

"Oh, hang her grandfather!"

"My boy, that's just what they did do."

* * *

"My dear lad, what will your father say about your fishing? It's Sunday!"

"Well, last time 'e said: 'Where the 'ell's the fish?'"

* * *

The following composition on men is credited to a little girl: "Men are what women marry. They drink and smoke and swear, but don't go to church. Perhaps if they wore bonnets they would. They are more logical than women and also more zoological. Both men and women sprung from monkeys, but the women sprung further than the men."

* * *

Figg—Well, how do you like having a place in the country? Hasn't the exercise done you good?

Fogg—Yes, and so has the real estate agent.

"Now, boys," queried the teacher, "who can tell me anything about the dead languages?"

"They are languages that were killed by being studied too hard," answered the boy at the foot of the class.

* * *

Hicks—Mathers is one of those simplified spelling cranks, isn't he?

Wicks—I should say so! He spells wife "yf."

* * *

"I am sending you a thousand kisses," he wrote to his fair young wife who was spending her first month away from him.

Two days later he received the following telegram:

"Kisses received. Landlord refuses to accept any of them on account."

Then he woke up and forwarded a check.

* * *

"Did the recent drought hurt you farmers much?"

"I should say it did," answered Mr. Corntassel. "We used to make a heap o' money haulin' out automobiles that got stalled, but while that drought was on we couldn't afford enough water to keep up some of our best mud holes."

* * *

A French evangelist, who knew very little English, was fond, none the less, of speaking publicly in the unfamiliar tongue. One Sunday he was exhorting a congregation composed chiefly of Americans and English and startled his hearers by launching forth into a prayer ending with,

"And now, good Lord, we pray thee to protect and pickle us all the rest of our lives."

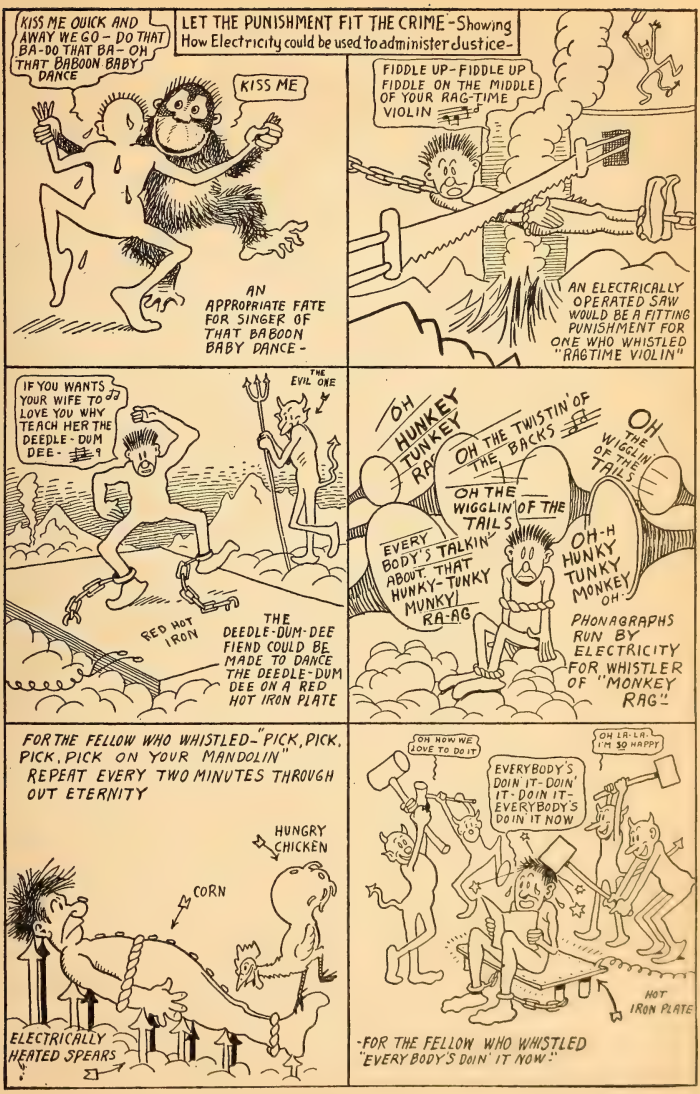
When the service was over the ambitious linguist's attention was called to his expression, "pickle us."

"Well, what would you?" said he. "Is it not the same, to preserve and to pickle?"

* * *

American Tourist (gazing into the crater of Mt. Vesuvius): It looks just like the infernal regions.

English Tourist: O, I say. How these Americans do travel.


KISS ME QUICK AND AWAY WE GO – DO THAT BA-DO THAT BA– OH THAT BABOON BABY DANCE
LET THE PUNISHMENT FIT THE CRIME – Showing How Electricity could be used to administer Justice–
KISS ME
AN APPROPRIATE FATE FOR SINGER OF THAT BABOON BABY DANCE–
FIDDLE UP– FIDDLE UP FIDDLE ON THE MIDDLE OF YOUR RAG-TIME VIOLIN
AN ELECTRICALLY OPERATED SAW WOULD BE A FITTING PUNISHMENT FOR ONE WHO WHISTLED "RAGTIME VIOLIN"
IF YOU WANTS YOUR WIFE TO LOVE YOU WHY TEACH HER THE DEEDLE-DUM DEE-
THE EVIL ONE
RED HOT IRON
THE DEEDLE-DUM-DEE FIEND COULD BE MADE TO DANCE THE DEEDLE-DUM DEE ON A RED HOT IRON PLATE
OH HUNKEY TUNKEY RA
OH THE TWISTIN' OF THE BACKS
OH THE WIGGLIN' OF THE TAILS
OH THE WIGGLIN' OF THE TAILS
EVERY BODY'S TALKIN' ABOUT THAT HUNKY-TUNKY MUNKY RA-AG
OH-H HUNKY TUNKY MONKEY OH-
PHONAGRAPHS RUN BY ELECTRICITY FOR WHISTLER OF "MONKEY RAG"
FOR THE FELLOW WHO WHISTLED–"PICK, PICK, PICK, PICK ON YOUR MANDOLIN" REPEAT EVERY TWO MINUTES THROUGH OUT ETERNITY
HUNGRY CHICKEN
CORN
ELECTRICALLY HEATED SPEARS
OH NOW WE LOVE TO DO IT
OH LA-LA I'M SO HAPPY
EVERYBODY'S DOIN IT-DOIN' IT-DOIN IT-EVERYBODY'S DOIN IT NOW
HOT IRON PLATE
-FOR THE FELLOW WHO WHISTLED "EVERY BODY'S DOIN' IT NOW-"

Common Electrical Terms Defined

In this age of electricity everyone should be versed in its phraseology. By studying this page from month to month a working knowledge of the most commonly employed electrical terms may be obtained.

MULTIPLE-SERIES.—When several groups of devices, such as lamps, with the units of each group connected in series; that is, one after another, are so connected that the several groups are in multiple, the connection is said to be multiple-series. (See cut.)

Multiple Series

NATURAL MAGNET.—An oxide of iron possessing permanent magnetism. This mineral is also called lodestone.

NEGATIVE CHARGE.—One of the two kinds of electricity which theory supposes in considering electricity upon a conducting body.

NEGATIVE ELECTRICITY.—The kind of electricity with which a piece of amber is charged when rubbed with a flannel.

NEGATIVE POLE.—In a magnet the south pole, the pole which the lines of force are assumed to enter. In an electric generator the terminal to which the current flows from the external circuit. In a battery the plate corresponding to the zinc plate in an ordinary voltaic cell.

NEUTRAL LINE OF COMMUTATOR.—A diameter line of a commutator which marks the points on which the brushes should be set. This line is practically perpendicular to the direction the lines of force take through the armature.

NEUTRAL WIRE.—The middle or central wire of a three system.

NON-CONDUCTOR.—Any material that does not carry electricity except with much difficulty because of its high resistance.

NORTH POLE.—The pole of the magnet that tends to point north.

NON-MAGNETIC WATCH.—A watch in which the hair spring, lever and escapement are made of materials, such as the Paillard alloys, that cannot be magnetized.

OHM.—The practical unit of resistance. The legal ohm is the resistance of a column of mercury one square millimeter (.055 sq. in.) in cross sectional area and 106 centimeter (41.6 inches) long.

OHM'S LAW.—The law which expresses the relation between the current flowing in a circuit, the resistance of the circuit and the electromotive force in the circuit. Algebraically it is written, $C = \frac{E}{R}$, in which C represents the current, E the electromotive force and R the resistance.

OIL TRANSFORMER.—A transformer in which the coils are immersed in oil as an insulator. In case of a break in the insulation the oil immediately fills in and closes the break-down gap.

OMNIBUS ROD.—See Bus Bar.

OPEN CIRCUIT.—An electrical circuit in which the wires are not continuous because of a break or because a switch is open.

OPEN CIRCUIT BATTERY.—A battery especially adapted to be used on circuits where current is used intermittently. Such a battery must not run down when left idle. The Leclanché cell is an example of this type of battery.

OPEN COIL ARMATURE.—A motor or dynamo armature in which the coils are not joined in one closed circuit but have their ends connected each to a commutator segment or bar.

OSCILLATORY DISCHARGE.—A discharge as from a Leyden jar in which the current rapidly changes direction. The discharge is really a rapidly alternating current of very short duration.

OUTLET.—The places in the electric light wiring of a building where fixtures for incandescent lamps are attached.

OUTPUT.—Commonly applied to the rate at which electrical energy is delivered by a dynamo or alternator.

OVER COMPOUNDING.—In a compound wound dynamo; that is, in one having both a series and a shunt winding, these windings are proportioned so that as the load increases the voltage at the terminals of the machine rises to make up for the increased drop on the line. This is done by providing more turns on the series coil. As the current to the outside circuit increases the amperes flowing in the series coil increase, causing a stronger field and consequent higher voltage at the dynamo terminals.

OZONE.—A form of oxygen stronger than ordinary oxygen gas, because it is made up of three portions or atoms of the gas chemically combined. An electric spark or a lightning discharge cause this peculiar combination, the ozone being readily recognized by its peculiar odor.

PAGE EFFECT.—The sharp tick heard when a bar of steel or iron is quickly magnetized or demagnetized. Theory assumes that the molecules of the bar change their positions at each magnetization and demagnetization, this action causing the audible sound.

PALLADIUM.—A metal closely allied to platinum and used as an ingredient of non-magnetic watch alloys.

PANEL BOARD.—A marble or slate board upon which fuses and knife switches are placed and from which branch lighting circuits or lines to motors are taken off. Panel boards are usually enclosed in steel or asbestos lined cabinets.

Popular Electricity
In Plain English
Henry Walter Young, Editor

Vol. V June, 1912 No. 2

CONTENTS

	Page
Phonographs and the Man That Invented Them. By Frank Parker Stockbridge	105
Double Deck Electrobus in London	111
A Public Unfamiliar with Coal	111
Ripening Walnuts by Electricity	111
Electric Radiators in Bears' Dens	111
Laying Telephone Cable in the English Channel	112
Arc and Incandescent Lights	114
Men Who Follow the Law of Ohm. By John F. Gilchrist	115
Brief Sketch of the National Electric Light Association. By T. Commerford Martin	116
W. Winans Freeman	118
Louis A. Ferguson	119
Dudley Farrand	120
Charles L. Edgar	121
W. C. L. Eglin	121
Henry L. Doherty	122
William H. Blood, Jr.	123
Electric Pumping Plants	124
Cars Helped by Counter Weights	124
Aids to the Partially Deaf	125
Electricity from Peat	125
CHARLES PROTEUS STEINMETZ	126
Regulator for Street Car Lights	128
"EAVESDROPPING BY SCIENCE." By Edward Lyell Fox	129
Mouse Carries Thread Through Pipe	132
ELECTRICAL SECURITIES. By "Contango"	133
A New Use for Tungsten	135
An Automatic Wheelsman	135
An Outdoor Elevator	136
Miniature Motion Picture Machine	136
Street Cars to the Leaning Tower	137
Two Shows in One	137
A Pennsylvania Farm Electrified	138
Telephone Dispatching System for Taxicabs	139
Electricity Cheaper than Steam in Seattle Mills	140
Beefsteak by Wire	140
Measuring Starlight	141
Some Odd Facts About the Telephone	141
Floating Power Plant Protects Piling	142
Toned Telegraph Signals	143
Electric Truck Makes Record Run	143
THE CASINO TECHNICAL SCHOOL FOR WOMEN. By R. J. Watson	144
An Electrical Hygrometer	146
Death of Prof. Antonio Pacinotti	146
Monorail System for Lumber Mills	148
Proving the Engineer Alive	149
A Rat's Handiwork	149
Individual Telephone Transmitter	149
ELECTRICITY AIDS THE DATE INDUSTRY	150
Electricity Direct from Heat	151
Deaf Mute "Telephone"	152
U. S. Asbestos Production Doubled	152
Portland Regrade Operation	153
HOW TO BECOME A TELEGRAPH OPERATOR. By an Operator	154
Walking on a Magnetized Floor	155
Unusual Feature of the Paris Subway	156
Electric Versus Gravity System for Irrigating	157
Searchlight on Repair Wagon	158
Largest Lightning Arrester in the World	158
A New Cord Aid Switchboard	159
THE NEW CAMBRIDGE SUBWAY TO BOSTON. By Livingston Wright	160
The Modern Sculptor	162
Electric Fans in India	163
Electric Dryer for Letter Press Copies	163
Automatic Temperature Regulator	164
Fans for Scaling Room	164
A New Type of Fan	164
Boiling Water in a Hurry	165
European Farm Motor	165
Shoe and Hosiery Display Device	165
New Type Instantaneous Water Heater	166
Filtering Air for Dynamos	166
Paper Cutter for the Job Printer	167
Handling Cane in Sugar Mills	167
Trimming Off the Rough Spots	167
ELECTRICAL MEN OF THE TIMES. Matthew Arbuckle	168
Adapting the X-ray to Minor Surgery	169
ELECTRICITY IN THE SUMMER HOME	170
Home Refrigerating and Ice-making Plant	172
Telephone Etiquette	173
The Silent Servant	174
The Federal Portable Power Table	176
Tools for Housekeeping	176
Washing Machine with the Washboard Principle	177
Electric Cooking Utensils	177
THORNE ELLIOT'S BURGLAR ALARM. By Clark DeBall	178
To Make an Electrophorus	181
Chemical Flasks from Electric Bulbs	181
A Static Motor	182
The Magic Toboggan Slide	182
Electricity Introduces Juggling Act	182
Projecting Postcard Pictures	183
Electric Bell Attachment for Dart Board	183
The Dancing Doll	183
The Magnetic Detector	184
Wireless at Catalina Island	185
Wireless Hints	185
TESTING WIRELESS IN THE DESERT. By Jesse H. Euffum	186
San Francisco Hears Wireless from Korea	189
Hook-up for Long Distance Work	190
Directory of Wireless Clubs	190
TRANSFORMER CONSTRUCTION. By Wesley G. Paulson	192
Watch Demagnetizers	197
Motor Operated Valve	197
Shock Absorber in a Rosette	197
Electro-Magnet with Automatic Switch	198
A Homemade Electric Sign	198
Increasing the Telephone's Range of Usefulness	199
A Floor Tread Switch	199
Neat Fastening for Entrance Wires	199
Electro-Plating on Glass and Porcelain	199
Improvements in Moving Picture Machines	200
For the Amateur Wireman	201
Pliers Made from Fiber	201
A Cheap Mellow Light	201
Refinements of Electrical Measurements	202
Aging Cheese Electrically	202
Power from the Ocean Waves	202
Proposed London Postal Subway	202
Naples Deep Running Subway	203
Electric Cars of Aluminum	203
Central Station Power in Time of Strikes	203
Wireless From Airships	203
The Dignity of the Wireless	204
Electric Heating in Swedish Homes	205
The Firefly's "X-ray" Light	205
Short Circuits	207
Common Electrical Terms Defined	208

RENEWALS When your subscription expires, you will find a renewal blank enclosed here. You should fill out and return with remittance at once to avoid missing a number. Positively no copies will be mailed on any subscription after same expires unless renewed, and we cannot agree to begin subscriptions with back numbers. The date on wrapper of your magazine shows issue with which your subscription ends. The extension on this date to period covered by renewal is sufficient receipt. If any other is desired it should be requested at time of renewal.

CHANGE OF ADDRESS Notify us promptly of any change in your address, giving both the old and new location. Since our mailing list for each issue closes the 5th of the preceding month (i. e., list for February closes January 5th), changes received after the 5th must necessarily take effect with issue for second month following. Postmaster as well as Publisher should always be notified of changes in order to forward mail sent to old address.

ISSUED MONTHLY BY POPULAR ELECTRICITY PUBLISHING CO., Commercial Bldg., Chicago, Ill.
YEARLY SUBSCRIPTION, $1.50; CANADIAN, $1.85; FOREIGN, $2.25; SINGLE COPY, 15 CENTS

No additional copies will be sent after expiration of subscription except upon renewal.
Entered as Second Class Matter April 14, 1908, at the Post Office at Chicago. Under Act of March 3, 1879.

Copyright 1912, by Popular Electricity Publishing Co.

MR. EDISON AND HIS YOUNGEST SON CHARLES—A YOUNGSTER WITH AN INSATIABLE APPETITE FOR KNOWLEDGE

Popular Electricity
In Plain English
VOL. V JUNE, 1912 No. 2

Phonographs and the Man that Invented Them

By FRANK PARKER STOCKBRIDGE

When I was a very small boy a man came to our school one day and showed us the queerest looking machine we youngsters had ever seen. It looked as though he had borrowed his mother's rolling pin, covered it all over with the tinfoil from as many yeast cakes as Daniel Clark ever had in his grocery store at once, put a little crank on the end of the pin and hung it between two uprights so that when the crank was turned the tinfoil-covered rolling pin would revolve. Any boy could see that far into the mechanism; but what we couldn't understand was the big tin funnel that stuck out at right angles to the rolling pin—such a shaped funnel as every one would call a "megaphone" today, but as megaphones hadn't been heard of then, the only thing we could compare it with was the speaking trumpet Peter Hopkins hollered through when the fire company turned out. Peter Hopkins was the captain, and all he had to do was to holler.

Of course, we were curious, and our curiosity was only whetted when the man informed us that the odd looking device was called a "phonograph." "It is a talking machine," he said. "It was invented by Thomas A. Edison. Now, I am going to let one of you little boys talk into it, and you will hear the machine repeat what is said."

It was very plain that we didn't believe what he said. I know I didn't. I turned to Charlie Decker, who sat next to me, and whispered, loudly: "Aw, machines can't talk. He's going to do a trick."

I don't know whether the teacher heard that whisper or not, but just at that moment she caught my eye. "Come up here, Frankie, and talk into the machine," she commanded. I hesitated, but her compelling eye was upon me, and up to the platform I scrambled. There my wits forsook me utterly. I was rather proud of my prowess as a public speaker. Never a school "concert" occurred but I had to "speak a piece." But the notion of talking into the wrong end of a tin fish horn, as if I really believed the machine would talk back, completely unnerved me. I was dumb. I tried to remember the last "piece" I had recited, but not a word came. The man who owned the machine came to my rescue.

"Say 'Mary had a little lamb,'" he suggested, with kindly intent.

If I hadn't been completely benumbed and bewildered and utterly "rattled," I would have resented the suggestion indignantly. Why, that was only a "first-reader piece," and I had been spouting such advanced declamations as "Sheridan's Ride" and "The Wreck of the Hesperus" all winter. But not a syllable of one of these gems of rhetoric could I

cudgel out of my brain, so, after an instant of hesitation, which seemed an hour, I shouted the venerable nursery rhyme into the tin funnel.

The boys all laughed. What was worse, the girls laughed. I could feel my ears turning red as I stepped aside and feigned intense scientific interest in the next step of the experiment. I fervently hoped the machine would slip a cog somewhere and fail to work—for by this time I was convinced that the man took it seriously, at any rate. But there was no such luck in store for me. The man slid the tin horn back along the rolling pin, turned the crank, and out of the speaking trumpet issued such a squeaky, high pitched, ridiculous caricature of my own voice that even I had to smile. But the smile didn't last long. After the first word or two, I began to hope against hope that the thing would stop at the end of the first line. But the man who owned the machine was evidently proud of its accomplishments, and he ground away relentlessly to the bitter end.

The last few words were utterly lost in the gale of laughter that swept the school from the little ones in the front seats to the "sixth-reader class" in the back rows. I don't know how I got off the platform, but I know my face seemed as if it were on fire, and I had to bite my lips to keep the tears of chagrin and rage from flowing. I felt that I had been imposed upon and put in a false position as embarrassing as it was undeserved. I didn't hear a word the man said in the "lecture" that followed the —to me—painful exhibition, but when we went out for recess I *did* hear one of the boys call me "Mary." The fight that followed was a delightful relief to my pent-up emotions, but I still feel foolish whenever I think of my first adventure with the phonograph.

That was the first time I had heard of Thomas A. Edison. Not long afterwards, however, they began putting in telephones in our town. People today do not always think of Edison in connection with the telephone, but in that day he shared the honors with Professor Bell. There was rhyme that comes back to me out of the "weis-nicht-wo" which people used to regard as very clever indeed. Its title was "Electricity," and it ran like this:

"'Twas Franklin first that caught the horse;
'Twas harnessed by Professor Morse;
'Twas shod by Bell and Edison,
Inventors of the telephone."

There began to be a great deal of talk about Edison. We heard about electric lights. Then one day—I was in the High School then — it was announced that Main Street would be illuminated that night by electricity for the first time. Everybody in town went out and paraded up and down Main Street. They were arc lights and they spluttered, and lots of us were very much disappointed indeed. We had expected to see that part of town as bright as day. However, I don't remember that anyone blamed Mr. Edison very much, even though most of us were under the impression that he was responsible for the arc lights. The papers were full of a new kind of electric lights he was said to have invented, which would put the arc lights completely out of business. I don't suppose any scientific subject has ever commanded the space the incandescent light got for many years. Some one started a story that Edison had sent his new light up in a captive balloon—a wire running up the anchor cable—and that it gave a light brighter than the evening star, and was going to become a permanent beacon for ships entering New York harbor. People talked about that —called it the "Edison star"—and named the inventor "The Wizard of Menlo Park." Every little while some one would "discover" the Edison star through a telescope and write a letter to the papers about it. And before long the incandescent lights began to creep into use—looking like white-hot hairpins in bottles. And pretty soon Edison began to be regarded as an institution rather than a personality, and all sorts of

MR. AND MRS. EDISON AND THEIR THREE CHILDREN, MADELINE, THEODORE AND CHARLES

impossible and fantastic inventions and theories began to be attributed to him, and the world whizzed along so fast that people took every new thing as a matter of course, and hardly batted an eyelash when the moving pictures came out with Edison's name as inventor, or when phonographs began to sing instead of to squeak, or when anything else that was marvelous happened.

A good many years after the adventure of "Mary's lamb" I held an editorial position on a New York newspaper. One of my jobs was to open the "letters to the editor" and answer the questions of "Anxious Reader," "Constant Subscriber" and "Vox Populi." One day a man in Brooklyn wrote in to ask how he could identify the Edison star, which he understood was sent up every night

to a height of a few miles or more. A week or two later some one else wrote a similar inquiry. I found in the course of a year that I could rely on getting an average of two letters a month from people who still believed in the Edison star myth, 30 years after it had first gained currency.

Then, one day, going through some papers in the "morgue," as the files in which clippings and reference material generally are kept are termed in newspaper offices, I found an old, yellow, pen-written manuscript—40 or 50 pages of it—dealing with the life of Thomas A. Edison. The name at the head of it was that of a man who had been a "star" reporter in his day, but who, for years, had been merely a tradition in the office. And the date affixed to the document was 1879—nearly 30 years before!

Thirty years ago — and Edison was then already so famous that the newspapers had prepared for possible emergencies by having several thousand words of "obituary" material prepared and ready for use! It staggered me for a minute. I was almost 40, yet when I was a little boy Edison was already one of the world's great men—and he was still at it. And from another point of view, there was something almost equally staggering in the thought that although I was not yet 40, I had seen almost the whole development of electric science, and the very beginnings of the wonders which the world of today accepts as commonplaces, bearing the name of Edison. I decided that, at the very first opportunity, I would visit Mr. Edison and see with my own eyes the man who had done so much in one lifetime to change the whole aspect of men's affairs. The opportunity came, not once but several times, and I found Mr. Edison all that my fancy had painted him.

The first time I visited Mr. Edison at his laboratory and factory at West Orange he was deeply immersed in experiments with the X-Ray. It was a comparatively new thing then—at least, not as well understood as it is now. Two of his workmen had been badly burned by it—one, I believe, died afterwards. Mr. Edison himself had been affected.

"I've pulled one eye eighteen inches out of focus," he told me, "and have about ruined my stomach, but I'm still working eighteen hours a day."

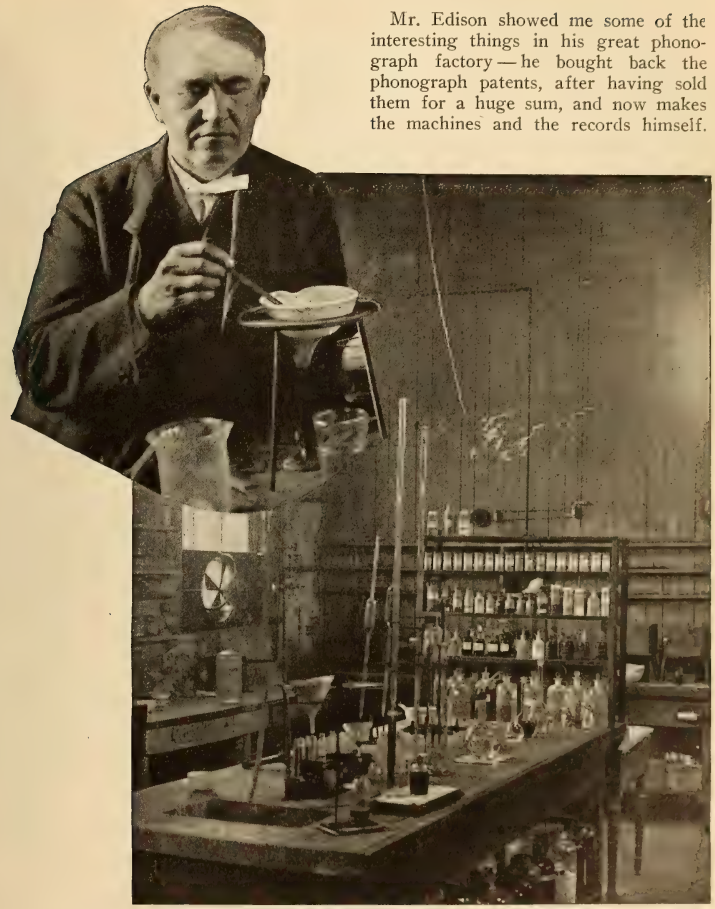
I had read, of course, about those eighteen-hour work days of the great inventor—the story of his ability to work for weeks on end with only four hours of sleep nightly, and sometimes not that much, has been current for years. I had classed it with the Edison star myth, but found it to be literally true. I asked him how he did it.

"One secret is that when I feel sleepy I sleep," he said. "I don't hear things that would disturb other people, for one thing."

Mr. Edison is not at all sensitive about his deafness. It has been a help to him, rather than a hindrance, the defective hearing caused by a railroad man lifting him by the ears when he was a train boy in Michigan, away back before the Civil War. It shuts out all the little sounds that keep most ordinary men's attention subconsciously diverted from the work in hand, and enables him to concentrate on the task before him, oblivious of what is going on around him. Once, however, it nearly cost him his life.

"I was working in the Western Union office in Cincinnati, in the '60's," he said, "handling press matter on a night wire. I always had a lot of books to read—everything I could get about electricity. One morning, about 3 o'clock, I was walking rapidly up Vine Street toward my room, with a bundle of books under my arm. I felt, rather than heard, a faint concussion behind me. I looked around and saw a policeman with his revolver pointed at me. I stopped and the policeman came up to me, angrily inquiring why I hadn't stopped before. It seemed he had seen me hurrying along with a bundle in the small hours of the

Mr. Edison showed me some of the interesting things in his great phonograph factory — he bought back the phonograph patents, after having sold them for a huge sum, and now makes the machines and the records himself.



FORTUNATE INDEED IS THE OUTSIDER WHO CAN GET TO HIM WHEN IMMERSED IN HIS EXPERIMENTS

morning and, suspecting me of being a thief, had called to me to stop. I had not heard him, and when I kept on without stopping, his suspicions had been confirmed, so he had fired at me. Luckily, he was a bad marksman."

Here was the concert hall, where musical "master-records" are made.

Since his illness of four years ago — from which he has entirely recovered — Mr. Edison, who is only 65 years young, has been giving a large share of his

attention to improving the motion picture camera. He has been working along two different lines. One is his plan of connecting the phonograph and the motion picture machine — synchronizing them—so as to enable the exhibition of "talking pictures."

"That problem is principally one of detail," he said, recently. "It is practically solved."

The other motion picture improvement is that of reducing the dimensions of the film, so that the cost is not only greatly reduced but the moving picture camera is made portable enough to be taken anywhere and used even by amateurs. And the inspiration for this came largely from Mr. Edison's twelve-year-old boy —a youngster with an insatiable appetite for knowledge.

"The motion picture machine with the quarter-inch pictures will replace text books in many lines," Mr. Edison says. "It will teach geography, for instance, as it is impossible to teach it now. I have a man now in Africa, taking motion pictures of everything he can find in the Dark Continent, the films of which will be more useful in schools than any books you can buy."

Once a year Mr. Edison allows himself a short vacation. Then he plunges into his work again, eighteen hours a day, and fortunate indeed is the outsider who can get to him while he is immersed in his experiments. There are a round thousand of patents to his credit already, and he keeps a patent attorney or two busy all the time preparing new applications. In his laboratories alone he employs a large number of the most skilful electrical and mechanical engineers, chemists and other experts, to work out the details of his ideas and carry on experiments under his direction. He is an organizer and business man of the first rank, and has probably made more money out of his inventions than any other inventor in the history of the world, with the possible exception of Alfred Nobel, inventor of dynamite.

The other day a man came into my office and suggested that I needed a commercial phonograph. He offered to send one in on trial. It came, and one night, when there was nobody around, I tried it. There was something the matter with the adjusticator of the whiffledorf, or something like that, and I couldn't get much satisfaction out of it. A day or two later the agent called again. I explained that the thing didn't seem to work as it ought to. "Let me try it," he said. He inserted the record with which I had been tinkering, twisted a screw here and tightened a nut there, and said: "Now I think it will work all right."

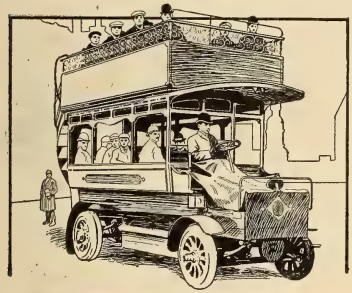
There were several friends in the room —people whose respect I want to retain, if possible. Naturally, they were interested in the phonograph. So was I, when the agent turned the switch and out of the depths of the instrument came, in my own unmistakable voice:

"Mary had a little lamb;
Its fleece was white as snow,
And everywhere that Mary went,
The lamb was sure to go."

Again I felt my ears burning and my face flushing. For a minute I was back in the old schoolroom again. I glanced at my visitors to see if they were laughing. I mentally dared them to laugh. They were more polite, at least, than the boys and girls of thirty-odd years ago. But if any one of them ever calls me "Mary"——

Double Deck Electrobus in London

London is noted for its cheap taxicab and omnibus service, and a large proportion of the people prefer to travel in



DOUBLE DECK ELECTROBUS

that way. Following the method there in vogue of building street cars with double decks, the London Electrobus Company is building its electric omnibuses with two decks.

A Public Unfamiliar with Coal

A statement was recently made by Mr. Edison to the effect that the time will come when the public as such will be unfamiliar with coal. All coal utilized will be consumed in central stations from which energy will be distributed for all lighting, heating and industrial purposes. In view of this prophecy, the proper work for the central station is to supply electrical energy for all possible services. Where such a result is accomplished the lighting load forms only from fifteen to twenty-five per cent of the total load on the station.

Ripening Walnuts by Electricity

An interesting new application of central service has been discovered in the California walnut country. The ripening of the nuts is now being artificially accelerated by placing the green nuts in trays, arranged in cabinets, beneath which there are electrically heated grids. Air is blown through the heated grids at low speed and warmed and thoroughly dried before passing over the walnuts, and it is possible by this means to accomplish in 24 hours a drying process that usually takes from a week to ten days, according to the weather.

Electric Radiators in Bears' Dens

During the extreme weather of last winter those of the bears not belonging to the polar variety in the Bronx Zoölogical Gardens, New York, were affected by the cold. To prevent the brown and the grizzly bears from the danger of pneumonia their cages were kept warm by electric radiators.

There was some fear lest the bears form too great an affection for electrical warmth, and bear-like try to embrace their glowing friend, so heavy iron bars were placed in the dens in front of each radiator.

BRUIN FINDS COMFORT BY THE ELECTRIC RADIATOR

Laying Telephone Cable in the English Channel

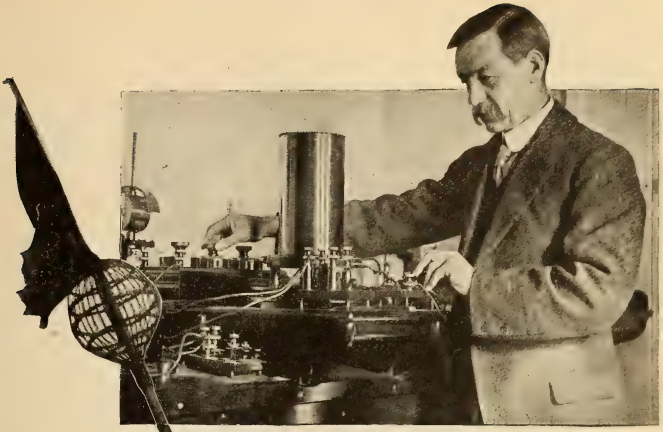
In order to give increased facilities for long distance telephoning between London and Paris, the present cables being heavily overtaxed, a new submarine cable is being laid in the English Channel. Starting from Cape Grisnez, the cable had been laid to Dover. During the operations five large buoys were placed in the water for the time being in order to mark the course of the cable. The steamer Cambria was employed in the work. Each buoy was lighted with two lamps, the top of the air-tight chamber being painted with the word "Telegraph" to warn vessels of what lay beneath in case they let go their anchors. At the top a flag marked the buoy by day. Each buoy was numbered and its position plotted on a chart, in case it broke adrift and the cable men wanted to locate the spot.

The buoys were made of sheet steel with a bell top, the bottom part being shaped somewhat like a funnel. At the bottom of the funnel was an iron frame, from which an iron chain ran to a weight that helped to steady it when in the water and keep it in place.

It was no small job laying this

Hauling Cable Ashore at Dover

Laying a Buoy to Mark the Cable

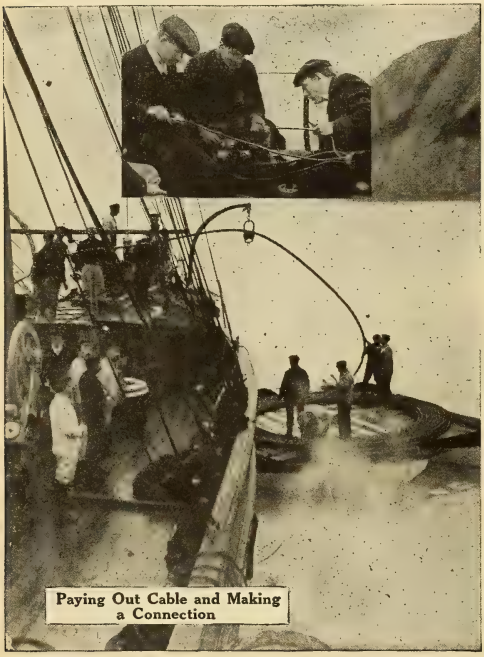


Testing the Cable

Laying New Telephone Cable Under the Channel

Fixing Lights on a Buoy

cable, which was done from a pontoon of three boats lashed together with a platform laid across their thwarts. The cable was reeled overside from the vessel, where it was wound on a large drum. When near the shore another boat acted as a guide and drag for the cable pontoon. Then it was carried ashore through the surf and among the rocks to the beach at Dover.



Paying Out Cable and Making a Connection

The work was done under the charge of Chief Electrician Redgrave of the Telegraph Construction and Maintenance Co., Ltd., for the French government.

Arc and Incandescent Lights

It is a curious fact that while the average person knows that, roughly speaking, there are two kinds of "electric light," the arc light and the incandescent light, he has a hazy notion of the difference between the two.

The arc light and the incandescent light differ in principle, in brilliancy, in appearance and in the mode of use. The distinguishing difference to an ordinary observer between arc and incandescent lights may be briefly stated thus: Arc lights burn in air with carbon sticks or pencils, the points or ends of which are heated to a white heat by the current and gradually consumed.

Incandescent light, on the contrary, is produced inside small glass globes of various shapes from which air has been exhausted. These lights are caused by the passage of electricity through a fine resisting wire or filament which is thereby raised to a white or incandescent heat without being consumed on account of the absence of air. If air leaks in, the filament immediately burns up, and that is the end of it.

The term "arc" is an old one, adopted years ago, referring to the shape of the electric spark in passing from one carbon point to the other with the carbons in a horizontal position.

Men Who Follow the Law of Ohm

By JOHN F. GILCHRIST
President of the National Electric Light Association

Not infrequently you may observe a man who wears in the lapel of his coat a button of the above design. He acquires the right by becoming a member of the National Electric Light Association, and he may be identified at once as being connected in some way with the electric light and power industry of the country. He may be an engineer or an officer in one of the great metropolitan companies furnishing light and power to the extent of hundreds of thousands of horsepower, or he may own or operate a small plant in Texas or Idaho or Maine whose sphere of influence is only a small village. The men of this great association are all bonded together by a common interest—to advance the methods of production, distribution, utilization and sale of electric current, and so their influence is felt in the communities where current is used.

The central emblem in the design of the button is very expressive, to the electrical man at least. The equation $C = \frac{E}{R}$ represents the fundamental law of electricity announced by George Simon Ohm over a century ago, and named after him "Ohm's Law." The fact expressed by the simple mathematical equation (that the current flowing in a circuit is equal to the electromotive force or pressure, divided by the resistance of the circuit) is one of the foundation stones of modern electrical science and achievement, and particularly so where electricity is distributed over lines of wires as in the case of an electric lighting system.

Members of the National Electric Light Association are found in all parts of this country, in Canada, Alaska, Mexico, South America, Cuba, Hawaii and the Philippines. Every year they hold a great convention in some city in the United States, where they gather together, two or three thousand strong, and discuss matters pertaining to the engineering and commercial phases of the industry, the papers and discussions being printed and sent to all members of the Association. This year, June 10 to 14, the convention will be held in Seattle, Wash., and although the city is in the extreme West a record breaking attendance is expected. Special trains will be run from Boston, New York, Chicago and St. Louis. Some of these tours de luxe will include side trips to Yellow-

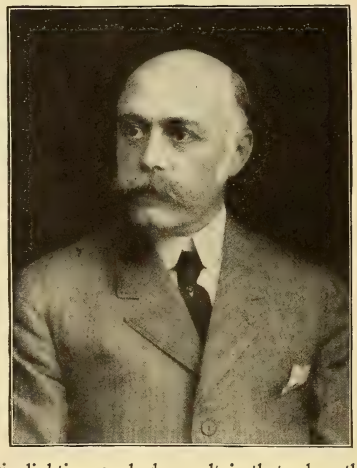
stone Park, Denver, the Grand Canyon and points in California.

The city of Seattle, under the guidance of the Seattle Electric Company, is making elaborate preparations for the reception of the guests. A great armory will be placed at the disposal of the association. Here the sessions will be held and there will be an extraordinary exhibition of electrical machinery and appliances of every type. Special illuminations in the streets will be a feature and inspection tours to points of interest in the western city and neighboring points provided.

In addition to the above message to the general reader I wish to say to the members of the N. E. L. A. that the Seattle gathering is going to be one of the greatest, in all respects, in the history of the Association, and your attendance there will be a benefit and pleasure to yourselves and a compliment to the present administration.

Brief Sketch of the National Electric Light Association

By T. COMMERFORD MARTIN, Secretary



The greatest body of its kind in the world today is the National Electric Light Association; born in Chicago, February, 1885, and now about to hold its thirty-fifth annual convention at Seattle, where it visits the Pacific Slope for the first time. This industrial and engineering body now has a membership of close upon 12,000 and spends on its general work upwards of $100,000 a year. In the early days of electric lighting anybody who had a plant, even if it was a small dynamo to run one arc lamp, could come into membership, but for some years past this membership has been limited to central station companies and their officers and employes and similarly to the manufacturing companies which supply apparatus for use in the generating plants and on the consumption circuits.

Some idea of the scope and influence of the Association may be gathered when it is stated that in an industry representing about $2,500,000,000 of capital and with an income of over $3 00,0 00,0 00 a year, it embraces in the 1,100 operating companies that are members not less than 90 per cent of the investments and the earnings. The result is that when the Association issues reports and recommendations whether as to line construction, accounting, electrical apparatus, terminology, lamps, motors, underground construction, power transmission, or as to other features of the business, its conclusions are adopted at once and virtually become law throughout the industry. From this ac-

crues an enormous gain in economy and efficiency, one result of which is seen in the fact that central station electrical supply is one of the very few things which has grown steadily cheaper in the age when every other necessity and all the luxuries have practically reached the highest prices known since the Civil War. There has also followed an enormous extension of the services and it may be safely asserted that, the country over, the relations between the companies and the public to which they supply electric light, heat and power, etc., are more friendly and more harmonious than ever before. This gain is largely due to the work of the Association.

In the way of organizing the industry the Association has proceeded along three parallel lines. One of these has been to affiliate or create state or geographical sections so that more than half the country and the Dominion of Canada are thus represented in its ranks and in its governing body through the local organizations. The second line of development has been that of company sections, of which there are now some 50 in the larger companies, with several thousand members from among the officers and employes. An enormous amount of educational work is done through these adjuncts. The third parallel line is that of national sections, devoted to a specific part of the industry such as Commercial, Power Transmission, etc., and these national sections are growing rapidly in interest and importance. The Commercial Section for example has already between 1,200 and 1,500 members. It is believed that by means of these processes of development the membership of the Association will easily be carried during the next five or ten years to 25,000 or even 50,000 members.

The great work of the Association is done through its annual convention, which usually lasts three or four days, with two or three sessions daily, at which some 60 or 70 reports and papers are presented and discussed by the leaders in the art. The papers are always carefully selected and the reports come from some 50 standing committees made up of the best known experts connected with the member companies. The proceedings of these conventions are issued annually and are in great demand. The Association in addition does a large amount of publishing and has issued for example an electrical solicitors' Handbook, of which some 12,000 copies have been sent out; a standard system of accounting; an annotated index of its proceedings for the first 25 years; a digest of the first seven years of its Question Box; valuable reports dealing with welfare work and the laws relating to Public Service Commissions, and single reports which are in steady demand on meters, overhead line construction, preservation of poles and cross-arms, and kindred subjects. The Association issues also a monthly Bulletin, which has rapidly become a standard magazine in interest and contents, and now has attained an edition of 12,000 copies per month and a size of from 80 to 100 pages. It's special feature is the Question Box, which publishes every month questions and answers as to problems which have arisen in the conduct of the business. This enables every reader to bring himself right up to date on even the most difficult subjects and perplexities of the hour.

As an example of the work which the Association assumes in its public and national capacity may be mentioned the Commission, which it organized recently with the aid of the American Medical Association, for inquiry into the best methods for resuscitation from electric shock. A body of distinguished men are now engaged in promulgating a report which will be final and conclusive and which is being eagerly awaited by the entire electrical world. It is in this and other public spirited, high minded ways that the Association has reached its present position of commanding influence and bids fair in the near future to transcend all the many notable achievements that have already attended its career.

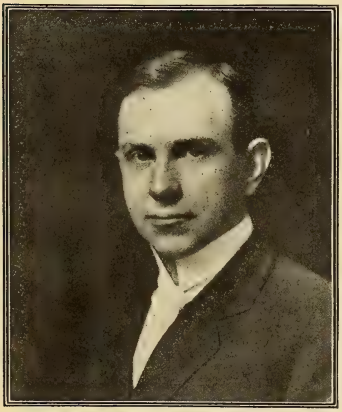
Some Past Presidents of the N. E. L. A.

ANECDOTES AND REMINISCENCES OF SOME OF THE MEN WHO IN THE PAST HAVE GUIDED THE AFFAIRS OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION

W. Winans Freeman

Vice-president and General Manager of the Edison Electric Illuminating Company of Brooklyn

Associates of W. Winans Freeman are fond of saying that he possesses marked power of hypnotism, and though he scoffs at the suggestion, they offer many incidents in proof. The truth is that Mr. Freeman is a close student of the psychology of human nature and profits by reason of the knowledge he has acquired. He is a natural leader of men because he has the rare power of persuading men to do as he desires them to do, and yet leaves them convinced that they have had their own way.



His methods are peculiarly his own. Ideas are one of his best stocks in trade. These ideas are suggested to others in authority, while no one but Mr. Freeman is conscious of the process. Then with infinite patience he waits until his ideas have been digested and assimilated by the one to whom they have been given, and when the results have been produced he is the first to offer congratulations upon the good work done and the power of initiative displayed. That is what his friends mean when they say that he is a hypnotist.

It is methods such as these that have made a great big working family out of the employees of the Brooklyn Edison Company.

About six years ago Mr. Freeman became convinced of the advisability of treating business corporations as profit sharing institutions. Service annuities for the employees also won his approval. Quiet inquiries convinced him that those then in authority in the Brooklyn Edison Company were not quite ready for the innovation. So he started his hypnotic influence at work, and with only a few knowing of what he was attempting to do, he successfully prepared the minds of his associates for the suggestion which he intended they should themselves make.

So it happened that profit sharing and service annuities were introduced as a part of the Brooklyn Edison Company's policy, with more than one hugging to his heart the delusion that the plan had been born of his initiative. Mr. Freeman has been satisfied to note the result —the tremendous efficiency of the corporation which commands his services.

W. Winans Freeman started with the Edison Company 22 years ago at a salary of $22 a week. He began as stenographer to the general manager. His first promotion came when he was made assistant secretary. He was not satisfied to do his work and go home; he made a study of the affairs of the corporation, and in a very few years, when

his official supervisors desired any information that concerned the Edison Company, and which was not readily at hand, they asked Freeman. So general became this custom that "Ask Freeman" passed into an axiom and a byword. Naturally, now that he is vice-president and general manager, it is more in use than ever.

There are never any peaks in Mr. Freeman's temperament curve. He always has complete control of himself under all conditions. One of his friends tells an amusing story illustrating this characteristic.

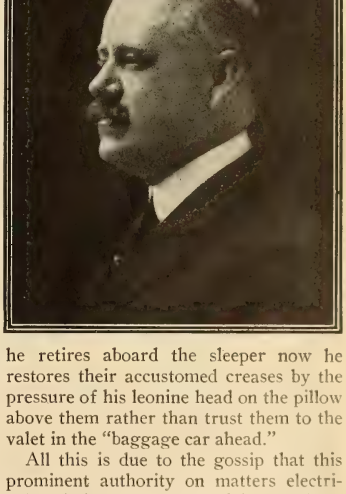
Mr. Freeman is an ardent golfer, and, as the story goes, he undertook to make a mashie shot over a bunker of stones, striking the ball with a long stroke. The ball encountered one of the large stones and came back as fast as it went, striking him in the right eye which promptly swelled to large proportions. Now the average man under such circumstances would have become vicious and said things more expressive than elegant. But Mr. Freeman's only comment in this particular case was: "My, but that was a hard crack!" Then, with his usual whimsical half smile—in the uninjured optic—he set about, very methodically and coolly to make that bunker.

Louis A. Ferguson

First Vice President of the Commonwealth Edison Company, Chicago

Ten years have passed since Mr. Louis A. Ferguson was president of the National Electric Light Association, and since which time he has also been president of the Association of Edison Illuminating Companies, and of the American Institute of Electrical Engineers, being the only man who has thus been honored with the presidency of the three great electrical associations of this country. Notwithstanding all these honors and the natural cares of a strenuous business and professional life he is still the same jolly, good natured "Louie," as his intimate friends call him, and has still the same wonderful resource and sledge hammer energy as in the days when he furnished allopathic doses of ginger and "light" to the N. E. L. A. conventions by his discussion with John W. Howell on incandescent lamps, or with H. A. Wagner on distribution, or with H. L. Doherty on rates.

There is just one subject that even his most intimate friends do not mention in the presence of the versatile Mr. Ferguson and that subject is "Pants." The natural instinct to be watchful over one's wallet or other possessions of value is in his case concentrated on that particular article of his wearing apparel and when



he retires aboard the sleeper now he restores their accustomed creases by the pressure of his leonine head on the pillow above them rather than trust them to the valet in the "baggage car ahead."

All this is due to the gossip that this prominent authority on matters electrical, technical and commercial, could have been seen, and, in fact, was seen promenading the railroad track near Rochester, New York, one cold winter morning about 2 o'clock with some of the famed ladies of Chicago society. In addition to the unusual features of the time and place for such a promenade it was observed that as far as one could see

Mr. Ferguson was clad in overcoat and shoes with some inches of gay colored pajama legs showing between.

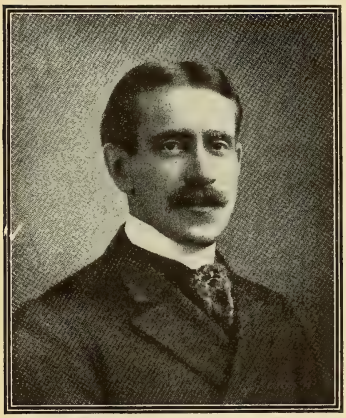
The explanation is that Mr. Ferguson was on his way to New York and there had been a wreck, in a small way, of the "Century;" the front portion of the train speeding miles down the track before it was discovered that the rear coaches had been derailed and left behind. The valet had the trousers some miles further on the way to New York.

Dudley Farrand

General Manager of the Public Service Electric Company of New Jersey

Two New Jersey "commuters" were standing on the forward deck of a North River ferry boat, discussing human nature and its vagaries.

"I'm looking for a man," said one of them. "I've got a mechanical wonder



who can take any old kind of raw material and construct a machine out of it that will work. I've got a fellow who can carry out orders to the letter—provided the orders are carefully written out and explained to him. I've got another fellow who can do anything either of the others can, but when it comes to trying something new, he always comes back with the objection, 'It can't be done.' Now, I'd swap the three of them for one man who could tell other people how to do things—who doesn't have to have a book of rules to go by."

"There's only one man like that, so far as I know, and he's got a good job now," replied his friend. "He can take a cake of soap and a coil of wire as a starting point, and show a gang of workmen how to construct a piano player or an aeroplane around that nucleus. I don't think he ever paid any attention to a rule in his life—he makes up his own rules as he goes along."

"Who is he, and can I get him?" asked the first "commuter." "I'll pay a man like that any salary he demands."

"His name is Dudley Farrand, but you can't get him at any price," replied the other. "He is general manager of the Public Service Electric Company, and he's never worked anywhere else in his life. It doesn't make any difference how high you bid—they'll bid higher to keep him."

A friend of Mr. Farrand, who overheard the conversation just quoted, declared that he had never heard a better characterization of the man who is responsible for the electric lighting service in 161 municipalities in the State of New Jersey.

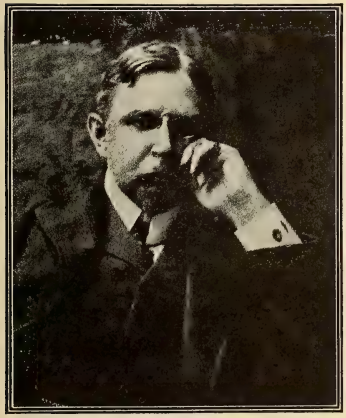
Mr. Farrand's early ambition was to go to Princeton University and study civil engineering. The death of his father, just as he was preparing to enter college, made this impossible. He was offered an opportunity to study law, but instead accepted an offer to become the entire office force of the Newark Electric Light and Power Company. His friends say, incidentally, that he has been pretty nearly the whole company ever since. At that time—1887—the company was equipped for 365 incandescent lights and 175 arcs—the largest central station in New Jersey. It did a gross business of around $25,000 a year, and young Farrand got the munificent

salary of $5 a week. But while he was running the clerical end of the business he was studying the operating end, giving his evenings and all his spare time to electrical engineering, and in 1892 he took hold of the "real work," as he calls the operation of an electric generating station.

Charles L. Edgar

President of the Edison Electric Illuminating Company of Boston

Mr. W. P. Hancock of the Boston Edison Company relates a good story concerning Mr. Edgar's early career. "In March, 1883," he says, "in the early days of the electric lighting business, I had a



job on the installation of an electric lighting plant in the factory of Seamon, Bache & Company, corner of Desbrosses and Greenwich Streets, New York.

"The second day we were at work there, a tall, young man made his appearance in the basement doorway. He was rather lightly built, nicely dressed, and in one hand he carried a tin, japanned box, marked 'Cake' in large, gilt letters on the sides. If I read his thoughts correctly, after first observing the expression on his face, he was mentally saying, 'What miserable hole is this?' To my great surprise, however, he put the box on a packing case, opened it, and what do you think—it contained wiring tools, and he was to help us out on that job.

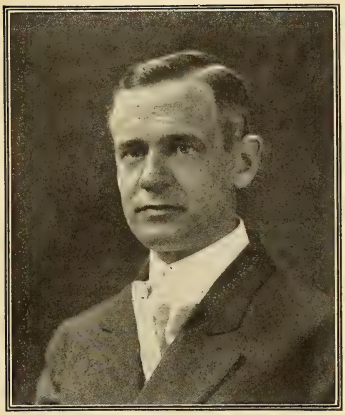
"For the first time since I had been in my new employment as an electrician, I moved out of range and laughed—not at the man but the tool box. He went at the work, but there was nothing to indicate that he was overflowing with the enjoyment of it. I mentally took one guess that he despised that work, and some time afterward he told me that I guessed right. That man was Mr. Charles L. Edgar, now president and general manager of The Edison Electric Illuminating Company of Boston, and a very honored past president of the National Electric Light Association.

"He didn't give up the work and go searching aimlessly for something easier, cleaner and more congenial. He stuck—'like a dog to a root,' and his determination, supplementing his ability, has carried him successfully upward.

W. C. L. Eglin

Electrical Engineer of the Philadelphia Electric Company

A few months ago the business of the Philadelphia Electric Company necessitated the erection and complete equipment of a 9,000 kilowatt sub-station. Now a 9,000 kilowatt sub-station is no toy, for be it remembered that 9,000 kilowatts is equivalent to over 12,000 horsepower. Moreover, the whole outfit with its frequency changers, exciters, switchboard, concrete compartments and auxiliary apparatus, had to be finished within the short period of four months. This was a job of the kind that mildly interested Mr. Eglin. He went at it, starting with the fundamental design, and saw it clear through, from the building foundation up to the throwing of the switches which connected it to the sys-



tem. Piles had to be driven. There were delays incident to inclement weather. There were other unavoidable delays in getting the apparatus together. But inside of the four months it was done.

For many years Mr. Eglin has been the electrical engineer of the Philadelphia Electric Company and its affiliated companies, and it is very largely due to his forceful personality and recognized engineering ability that the company is today in the front rank with the largest electric lighting companies of the world.

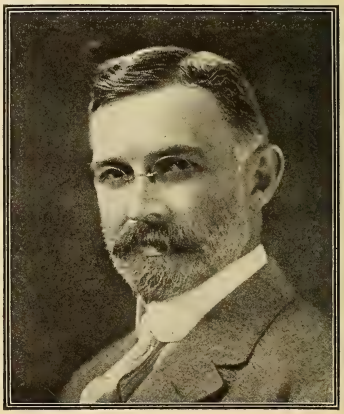
One of his most prominent characteristics is his constant thought for the advancement and uplift of the employee, and for protecting him against accident while engaged in the discharge of his duties. This being well recognized, a few months ago Mr. Eglin was appointed a representative of the Association on the Commission on Resuscitation from Electric Shock. This is a subject of vital importance to every one connected with the electrical industry; and the complete recommendations of this Commission, which also includes representatives of the American Medical Association and of the American Institute of Electrical Engineers, are being awaited with interest.

Henry L. Doherty

Head of the Firm of Henry L. Doherty & Company of New York

"Doherty luck" has been quoted so many times in public utility circles that probably some may believe that luck has played a great part in his advancement. Nothing could be further from the truth. Incessant work has had the most to do with the success of Henry L. Doherty. Even the time most men take for recreation is spent by him in work, but work that to him is the same as play to many other business men.

As an instance of this, some time ago Mr. Doherty had been for days engaged with some difficult engineering and financial questions which, finally solved, left him in need of what he calls "change of brain diet." Some days previous a friend had brought to his attention a chemical problem, which so far had failed of solution. It had to do with distillation and the friend said that if it could be solved, it would mean much for his business. A problem such as this is just the relaxation required by Mr. Doherty and so forgetting matters electrical for a time, he began to study the subject of distilling.



He solved the problem and the process evolved by him is now in use in the plants of his friend and incidentally an application for a patent on this process is now pending. With the solution of this question Mr. Doherty's play time was over and he returned again to his work.

A year ago Mr. Doherty was importuned by his partners and friends to forget business matters for a time, take a long vacation and go to Europe. He decided to do so and his friends declared that he would now have to have a real playtime away from all business. As events proved, however, they did not know their man. Mr. Doherty made the trip, had a good time, saw many countries and journeyed north to the midnight sun. But all the time his busy brain was at work, and after his return to his office the results of this work appeared in the announcement that the markets of Europe have been opened to the securities of the Doherty companies.

William H. Blood, Jr.

Of Stone & Webster; Insurance Expert of the N. E. L. A.

There is a certain resemblance between Mr. William H. Blood, Jr., and the great Cato, of whom it was said that "his powers were confined in no pent-up Utica." While Mr. Blood may not be able to exclaim with the Count of Monte Cristo "The world is mine," he is entitled to feel that the United States is his. For he has traversed it at the rate of about forty thousand miles a year for the last 20 years.

Practically every city in this country of over 10,000 population has been visited by him, and he has examined properties which represent over $1,000,000,000.

He is the peripatetic philosopher of the Stone & Webster organization. He is here today, and there tomorrow; now you see him, and now you don't. In his office he has a large map of the United States, and on every city that he has visited he has stuck a small black seal—it reminds one of a blackberry pasture when the picking is good.

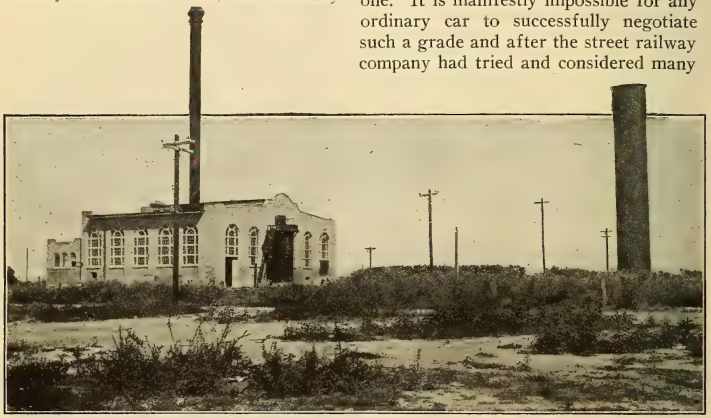
Mr. Blood's activities have been many sided and far reaching. For many years

he has had charge of the expert examinations conducted by Stone & Webster. He had a prominent part in the creation of the electric code. He has an intimate knowledge of insurance. He has displayed a lively interest in the development of the electric vehicle, and is now president of the Electric Vehicle Association of America. He is well known as a lecturer on electrical and industrial subjects, and as a writer on matters affecting public utilities.

But it is impossible to describe Mr. Blood without resorting to the language of the real estate dealers—"This property must be seen to be appreciated." One must know him personally, must note the calm judgment of his business views, must listen to his witticisms (which always instruct as well as entertain), must be the recipient of his unfailing good humor, in order to estimate him properly.

Electric Pumping Plants

Operating irrigation pumps by electricity is rapidly becoming general in Texas and the Southwestern States. In the shallow-water belt of the plains country of western Texas and in many



PUMPING PLANT IN THE LOWER RIO GRANDE VALLEY

parts of New Mexico and Arizona many small electric pumps have been installed in wells during the last two or three years. These pumps receive the power over transmission wires from central stations in the respective irrigated districts. In the lower Rio Grande valley of Texas is one of the largest electric power plants in the country devoted to operating irrigation pumps. The pumping station is situated upon the bank of the Rio Grande, from which stream the water supply for irrigating many thousand acres of land is obtained. The transmission lines run from the power plant to the pumping station.

Cars Helped by Counter Weights

What is claimed to be the steepest smooth rail hill climbed by electric cars is located in Providence, Rhode Island, called "College hill," the elevation on which Brown University is situated. The grade is about eight per cent and is the scene of the heaviest traffic on the local trolley lines. The rise is close to a foot in every ten feet and the hill is half a mile long so that the climb is a hard one. It is manifestly impossible for any ordinary car to successfully negotiate such a grade and after the street railway company had tried and considered many of the cograil propositions without success the engineers hit upon the scheme of counterweights, which was installed with most satisfactory results.

The counterweights weigh about sev-

BELOW THE TRACK SLOT RUNS THE COUNTER WEIGHT CABLE

29369

enteen tons each and run on an underground track and down the same incline that the cars do. The hill is double tracked and accordingly two sets of weights are in use, one to each track. In the center of each track a cable slot is utilized for a rolling grip to attach itself to the under part of the car. Special cars containing a single motor are used, which, exerting its full force, is just sufficient to move the grip car up or down against the effort of the counterweight. When other motor cars are being assisted up or down the hill they are switched in and coupled up behind the grip car and the power of both is used to make a fast trip up or down. This system gives a speed of more than twice that of any cog railroad known and though it would hardly work on a grade steeper than the one in which it is used on, it has proved eminently satisfactory where it is installed.

Aids to the Partially Deaf

Persons who are only partially deaf can often be made to hear very well by the use of a small electric device in the shape of a telephone, which fits into the ear. We illustrate one of the newest of these and it is the invention of Dr. Soret, of Havre. He uses a telephone transmitter which is acted on by the voice, and also a receiver so as to act upon the ear, but both of these are mounted together in a single box-like device. This is of very small size, and has a rubber tube made in the shape of the inside of the ear, so as to fit well into the ear.

Sometimes only one ear need be thus treated, just as a single eyeglass is carried. For both ears, the two devices can be joined by a light head piece passing in the rear. A small pocket battery gives the current.

Of another kind is the "microtelephone" made by Dr. Le Nouëne, and here the transmitter is made in the shape of a small disk-like box with perforated cover which hangs upon the breast. In the ear is inserted a very small telephone receiver which is almost invisible. A flexible cord connects the different parts, including the battery.

SORET APPARATUS IN USE

MICROPHONE OF DR. NOUENE

Electricity from Peat

The St. Petersburg Electric Lighting Company has acquired an extensive peat field near Moscow where it is proposed to erect a large electric plant. Electrical energy will be transmitted to Moscow, where the prices of naphtha and coal are unusually high. The quantity of peat available is sufficient to cover the fuel requirements of Moscow for a period of 100 years to come, according to conservative estimates.

Charles Proteus Steinmetz

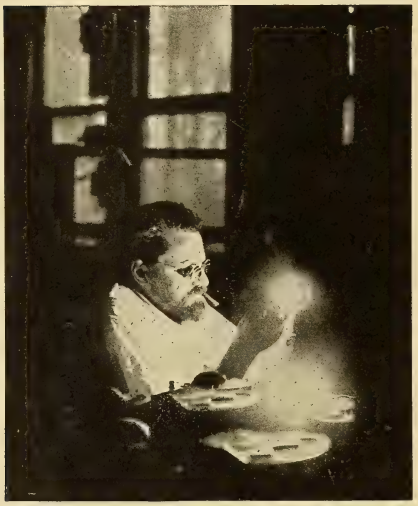


Photo by L. S. Uphoff

DR. STEINMETZ EXPERIMENTING WITH THE FLAMING ARC

When it was announced, a few weeks ago, that Charles Proteus Steinmetz had been appointed to head the school board of the city of Schenectady, N. Y., many persons who had known of him only as a famous electrical engineer wondered why and how this had come about. To those who really know Mr. Steinmetz, however, there was nothing surprising in his appointment.

"It's just another instance of Steinmetz living up to his middle name," remarked one of the men who knows him best. That sent those who heard the jesting comment to their encyclopedias. There they found that Proteus, in Greek mythology, was a prophet who knew all things, past, present and future, and who was able to take on any shape at will. Then they saw the point of the apt remark, for if Mr. Steinmetz has a claim to distinction beyond his skill as an electrical engineer and inventor, it lies in the fact that he knows more different things and has played more different parts in the world drama than most men. There is one important difference between Mr. Steinmetz and his mythological namesake, however. The ancient Proteus was loth to tell what he knew. Charles Proteus Steinmetz has no such scruples.

It is because he is always ready to tell what he knows, and has the ability to tell it interestingly and intelligibly to those who are not as well informed as himself that he is known familiarly to the men in the General Electric works at Schenectady as "The Professor." More than that, he really is a professor, occupying

Photo by Geo. D. Rosenthal

TWO GREAT INVENTORS IN MEDITATION—SAID TO BE THE BEST PHOTOGRAPH EVER TAKEN OF MR. EDISON AND DR. STEINMETZ

the chair of Electrical Engineering at Union University, Schenectady, which he has held for many years. And his earliest ambition—or at least one of his early ambitions—was to be a professor of mathematics in a great German university. If he hadn't tried being an editor first he might have achieved that distinction, and Germany, rather than the United States, would be claiming the credit of his inventions.

It was while he was a student at the University of Breslau, in which city he was born in 1865, that the editorial bee found lodgment in young Mr. Steinmetz's bonnet. A friend of his was editor of a Socialist paper and was sent to jail in the cheerful way they have of sending Socialist editors to jail in Germany. Steinmetz undertook to edit the paper while his friend was doing time. He succeeded so well that the police confiscated the whole paper. Thereupon Steinmetz started another, using the name of a harmless acquaintance as "responsible editor." Before long this publication was also suppressed. Incidentally, the police discovered that Steinmetz was the man who had been writing the articles that had got under the official skins of the ruling powers and reported the fact to the university authorities. They did not want to expel Steinmetz, for he was their most brilliant student, but he learned, through one of the student-detectives, that there was a warrant out for him and went away from there. He threw the police off the scent by buy-

ing a round-trip ticket—it is easy to throw the Prussian police off the scent, apparently, for the destination of his journey was a point on the Austrian frontier. He did not use the return half of his ticket, but continued across the frontier to Vienna, thence to Zurich, where he wrote articles for the Breslau papers, studied chemistry and electrical engineering, decided to go back to Breslau and try for the post of professor of mathematics, but finally fell in with a young American whom he accompanied to this country, arriving at New York with $20 between them. He went to work for an electrical concern which soon after was bought by the General Electric Company.

"Steinmetz was the most valuable part of the whole plant," said one of his friends recently. "The General Electric got a real bargain without knowing it."

That he would have made good as professor of mathematics nobody who has come in contact with his tremendous faculty for figures doubts for a moment. It was told as a joke on the late General Frederick Dent Grant that when he was a cadet at West Point he misunderstood the instructions of the professor of mathematics and sat up all night trying to commit the table of logarithms to memory. But it is no joke to say that Professor Steinmetz really did that very thing—or what amounted to an even more stupendous feat of mental labor.

A few years ago he consented to accompany a party of friends on a hunting expedition in the Adirondacks. Not being much of a hunter, he remained alone in the camp while the others went out after deer. While they were away he thought of a mathematical problem the solution of which required the use of a table of logarithms. There was no such table within several hundred miles, so, remembering a few of the figures, he sat down with pencil and paper and calculated a complete table. Then he solved his problem.

It may be relied upon that the pupils in the Schenectady public schools under the Steinmetz administration will have to learn arithmetic. Yet he has none of the adoration of mathematics for its own sake that some great mathematicians have had. "Mathematics is only valuable to attain results," he says. Mathematics for mathematics' sake is foolish." And it was not because he was a mathematician, or even because he is a university professor, that he was made head of the school board. It so happens that the present city administration of Schenectady is Socialist, with a Socialist minister, the Rev. Mr. Lunn, as mayor, and it was Professor Steinmetz's editorial experiences—together with his continuous advocacy of Socialism ever since—that had as much to do with his selection as anything else.

Of course, the work of the school board will not take him away from the General Electric Company, where he will continue to smoke his long, black cigars and to go without an overcoat, no matter how cold the weather—likewise to draw his salary of somewhat more than $50,000 a year, which isn't so bad for a Socialist.—Frank Parker Stockbridge.

Regulator for Street Car Lights

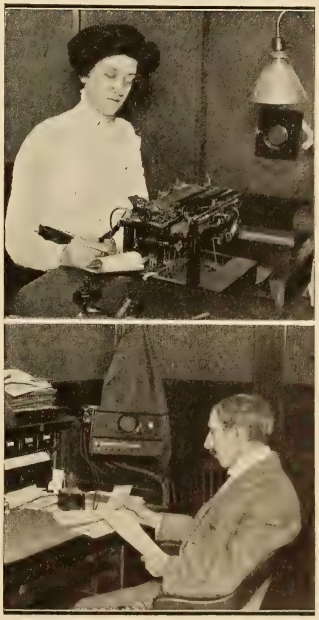
Those who read the morning and evening papers on street cars are aware of the fluctuating intensity of the light during the rush hours on account of the varying voltage. The lamps in street cars are usually connected in series; that is, five 110 volt lamps are connected in series with the trolley wire and the rail. A device to keep the current through the lamps steady is promised. It consists of a bulb, in appearance resembling a filament lamp. Within the vacuum bulb is a calculated length of iron wire the temperature and resistance of which change with the voltage. This bulb placed in series with the five lamps causes them to burn without flickering, according to reported experiments.

Eavesdropping by Science

By EDWARD LYELL FOX

The dime-novelist who first wrote "Hist! The very walls have ears!" wrote better than he knew. Then he wrote figuratively. Today he could write it literally because walls, you see, have grown ears! They're wonderfully alert ears, too. They catch the faintest voice; the rustle of clothing. They're susceptible to the slightest sound.

Of course, I mean the dictograph; the tiny instrument that in the last six months has revolutionized criminal detection. In walls, under sofa and chair, in chandelier, behind a desk, beside a window, it has hidden—the unseen listener to secret conversations. The secrets of prison cells have been tapped, hotel rooms and offices have given up incriminating conversation. To representatives of the law it has proclaimed loudly the whispered words of cunning malefactors. It has figured sensationally in the undoing of dynamiters, legislative bribe takers, grafters high and crooks low, across the continent. It eavesdropped in McManigal's cell in the bribery case, in the Lorimer case, in the office of the Iron Workers' Union at Indianapolis, in Gary, Ind., in—who knows? Always listening where we know not, it promises more and more sensational disclosures, more confessions—an "automatic third degree."



THE DICTOGRAPH IN BUSINESS LIFE

It was to learn more about this instrument that I went to see the man who invented it. I had read about it. The word dictograph had appeared frequently in the public prints, but always in a report of something criminal. Its importance morally was established. But was it of any use to the business man? Could it be made as essential to his office as, say, the typewriter? Surely the inventor could tell me. So I went to see him—K. M. Turner—and found him in a Broadway office building. It was in the theatrical district, very properly. Later, I learned that Mr. Turner made his dictographs in a factory out on Long Island, but one couldn't hold that against him. In his desk, you see, there are plenty for demonstrating purposes.

For a time he generalized in scientific theories applied to his invention. This over, he confessed the invention of the acousticon and the interior telephone, as well as the dictograph. And as abruptly he asked:

"Have you been dictographed?"

On general principles, I said "No,"

whereupon he asked me to stand in the most remote corner of the room and whisper, "Do you hear me?" This I did, pitching my voice so low that Turner himself couldn't have heard me. Imagine my surprise then, when, an instant later, there issued from a small wooden box beside his desk a distinct, full-toned voice that said:

"Yes! Of course I hear you."

I moved toward the box, and stood close against it. In a moment the invisible voice reported that a queer rustling sound had been heard. Mr. Turner said it was the motion of my clothes caused by breathing. I wondered if that infernal ear with its electric charged wires leading to some man in another part of the building could hear my heart beat.

"That!" suddenly remarked Turner, with a wave of his hand, "is the dictograph for the business man!"

And, rising, he dissected it verbally for me. The "commercial dictograph" consists principally of the transmitting disk or sound collector, which is the same as that of the "criminal dictograph," and an orifice which talks back the answer of the person at the "other end of the wire." In the box are half a dozen pegs which may be depressed to put the user in touch with as many instruments in adjoining offices. In fact, it is a wonderfully simplified form of the interior telephone. Only there is no "leaking" switchboard and no bother of taking down receivers from hooks. All you do is to sit in your office, talk and listen to the answers that, full-toned, come throbbing from the box. Thus you can dictate to a stenographer

PROF. FRANK PERRET, AMERICAN SCIENTIST ON MOUNT VESUVIUS, USING THE DICTOGRAPH TO COMPREHEND THE EARTH RUMBLINGS

CONVERSATION IS TRANSMITTED TO AN ADJOINING ROOM, UNKNOWN TO THE VISITOR, THROUGH A DIAPHRAGM CONCEALED IN THE CLOCK ON THE DESK

in an adjoining room and hold a business conference with several other rooms simultaneously.

"Corporations will have their meeting rooms fitted with dictograph ears," remarked Turner when we were seated. "It is applicable to all lines of business and professions. Then he told me how an officer of a corporation wanted to know the secrets of a room which had solid walls and no furniture except a desk in the center. Over the desk hung a chandelier, and at the base of the chandelier was a metal ball. In this was rigged a dictograph sound collector—the unseen ear. And a noted banker, he told me, has the instrument hidden in a clock on his desk. If he wants the conversation of a caller recorded he presses a button under the rug, with his foot, to notify a stenographer in the next room. She, pad and pencil in hand, sits beside her dictograph and writes.

Let us dwell momentarily now upon the "detective dictograph." Last year William J. Burns was regarded as the flesh and blood unification of Sherlock Holmes and M. Lecoq, with an Arsène Lupin dare-deviltry. That was before it became known that he used the dictograph. This with all respect to Burns' acumen as a detective, for he knew enough to make use of the latest that science had devised for catching criminals. Burns was the first American to see the immense possibilities of the instrument in detective work. He is so enamored with it that he always carries one in his pocket. Fictional detectives carry automatics and handcuffs. Burns carries a dictograph.

Let us see what this instrument is. Turning it over in our hand we estimate that it weighs a half pound. If we put it in a little leather case it looks like a small pocket kodak. Regarding its mechanics, there is a sound collector or transmitter, a receiving desk, a couple of small dry batteries and a double length of black silk covered wire. The sound collector is a disk of black hard rubber weighing a few ounces. It is about three inches across and an inch thick. There is a metal eye by which it may be hung on a nail behind a desk or a picture. The wires are inserted at the lower end of the disk. To the receiving disk which the eavesdropper holds to his ear the wires are connected at their terminus. Necessary current is provided by the dry batteries. Unlike the "commercial dictograph," no provision for a chat between

ANOTHER EXAMPLE OF THE COMMERCIAL DICTOGRAPH

two persons is made. An eavesdropper doesn't want to talk back to the person whose conversation he is overhearing.

This sounds simple. The construction of the mechanical ear, however, is most intricate. On the outer extremity of the sound-collecting disk is a series of oblong, semi-circular openings. Through these pass the vibrations of air which constitute sound. Inside there is a cone, the point of which is an electrode and which reaches the center of the disk. Vibrations of air, striking the bottom of the cone, are reflected back and forth. They climb a circular mountain, so to speak, and become focused at the center and peak of the cone. The action suggests a burning glass focusing the rays of light on a central point. The disk gathers the sound vibrations within a circle about nine and a half inches in circumference and transforms them into electrical impulses to be sent over a wire.

So much for the mechanics of the ear, that is said to multiply sound four hundred times. Now let us see how it came to be. One day when Turner, experimenting with his interior telephone, was waiting for the person at the end of the wire to speak, he chanced to overhear snatches of a conversation. Like a flash the idea of the eavesdropping dictograph came to him. Upon perfecting his interior telephone he turned his efforts toward the dictograph. At first he had a difficult time getting anyone to take his machines seriously for detective purposes. At the Thaw trial an assistant district attorney turned down his suggestions flatly. Then, as many other inventors have done upon meeting rebuffs in this country, he crossed the Atlantic. Obtaining an audience with the late King Edward of England, Turner showed him a form of his invention, and the monarch said: "Scotland Yard should have it." Later, Paris and other continental cities took it up. The European detectives used it and kept their mouths shut. Also, the European newspaper man is not a prying person like his brother in America. So we on this side of the ocean did not know that such an instrument existed. Finally the United States Secret Service got wind of it, and an alert, red-haired man, called "Billy" Burns, began to dabble with it. Now he's known as William J. Burns.

Not until a year ago did the first published notice of the dictograph come. Then it was in connection with the Illinois shop grafting case. Burns had such success with the metal ear in running down the grafters that he tried it on the McNamara dynamiters. He's been trying it on people ever since. Last summer the ear overheard the legislative grafters at Columbus, Ohio. The incident disgusted these higher crooks exceedingly. Not so the honest population of the city. They held a dictograph celebration. Today you can buy dictograph cocktails at Columbus. What better proof of its popularity could be given? Moreover, the Ohio Supreme Court upheld the dictograph as a legal evidence getter.

The surprising part about it all is that despite the publicity, the more it is used the more effective it becomes. Most people scoff at it until they have been sent to jail by its agency. Even then many of them are inclined to doubt. You cannot get around the fact that men must talk and the dictograph must listen. They cannot see it; they cannot find it. It's more elusive than the "dimmed elusive pimpernel" of Fred Terry fame. Wallpaper may hide it. Under a ventilator its ears may be cocked; the stone wall of a cell may hold it, unseen—yet it is always listening.

I recall an instance that Mr. Turner told me. Two Italian crooks were placed in the cell of a Pennsylvania jail. In the cell was a dictograph, and some distance away, waiting for the electric current to carry their conversation to him over the wires, sat an operator. For five days, fearing that they would be overheard, the Italians kept silent. On the sixth day they could endure it no longer and broke into speech. And the metal eavesdropper heard every word.

Mouse Carries Thread Through Pipe

The fact that even so small a creature as a mouse will prove invaluable at times was realized by a contractor, who had without success tried every available means to pass a pair of wires through 197 feet of conduit having a right angled bend about half way of its length. Finally it was suggested that a mouse might be used. One was caught and a thread was fastened to its leg. It was then placed in the mouth of the pipe and given a start by a whiff of compressed air. It appeared at the other end in a minute or so with the cord. The rest proved easy as the cord drew tape through the pipe and the tape drew the wires in.

Electrical Securities

The Proper Time to Buy Stocks and Securities in So Far as the General Public is Concerned—How to Buy Them—What to Buy and Why You Should So Invest Your Money.

By "CONTANGO"

You as an individual, part of the general public, doubtless have on various occasions had this or that electrical share or bond brought to your notice as a good opportunity for getting good dividends or interest on your money, year in, year out, and without any risk of losing it. This short article will endeavor to tell you when, how and what to buy.

The ground has been carefully covered in this "Contango" series in so far as good faith, the wide prospect before you, the pitfalls in the past, and other necessary considerations are concerned. It is now time to particularize a little more closely, without giving names, for after the suggestions set forth concerning frauds and fraudulent companies that is scarcely necessary, even though it would be quite easy to place before you a list of such undesirable companies.

Though much has been made clear as to what public service and public utility companies are, yet would-be investors are probably still in the dark as to when to buy with the best advantage, because prices sometimes seem high and sometimes suspiciously low, and in either case there is much uncertainty as to what to do and what not to do.

In times of business depression, in panicky times, there is no greater opportunity, but usually you are afraid to part with your money then, afraid to make a single forward step, lest you lose your small capital or savings. In times of booming business and of general confidence and good faith, you often hesitate because you are apt to think the price too high, or else your money might possibly find a better opportunity in some small business chance in the improving business conditions. In the slack period between the extremes you are hopelessly at sea, drifting along, fearing to take any initiative whatever. But opportunities for investment are always at hand, though you must be able to differentiate between the good and the bad.

The public utility or service company depends on the certain and constant growth of population and development of the country locally and generally. You can no more stop this than you can mark time in your steps through life. We have already in past articles discussed the question of management, amounts of stocks and bonds, and the like, and as a result it has certainly been made clear that when all these requirements of soundness have been fulfilled, you would have to search the world over to find a better stock or security for bringing you reasonable but certain returns than the issues of such corporations. On your stock—that is, shares—you may net, in strong companies, as high as 5 to 7 per cent per annum on your investment, and still the company be judged in the financial world as perfectly sound and reliable, and 4¾ to 5¼ per cent on your bonds is not too high a rate to expect.

The very fact that state commissions regulating such companies are being appointed from time to time only means further safeguards for your dividends and interest. Therefore the present time—and that means *now*—is always the best in which to invest your money in sound enterprises of this character. Do not for one moment lose sight of the fact that such opportunities come along from month to month, and if your money is not in them, it is probably idle or wasted in speculative chances.

Naturally, the electrical public service or utility—and this comprises many

power development companies—should prove very attractive, because electricity is so fast superseding every other form of light and power. The conclusions you should have drawn, and doubtless have drawn, then lead up to this *final note of action*—get your money busy and put it into the shares and securities of such enterprises.

Now, as to "How to Buy?" such stocks and bonds.

You will doubtless have noticed from time to time the advertisements of bond houses, bankers and brokers. As to the reliability of these houses you should judge by the class and standing of the publication in which they appear, and by making inquiries of your bankers or friends familiar with financial affairs. Sometimes they announce that they offer the stock or securities of this or that company at such and such a price; they also give particulars as to the rate of dividends or interest paid. It is to such houses you should write. You can also apply to your local banker in the case of companies whose circulars concerning their securities come to you direct, or who put out their own advertisements concerning the financial offerings or investment opportunities they are making to the public.

In practically all cases you pay a deposit on the allotment of stock to you, then the balance in two or more subsequent payments. The more important and substantial corporations, when declaring a dividend, declare it also on those shares partially paid up. On the other hand, cases have been known where, even when an individual has agreed to buy, say, ten shares in installments, and has paid up a quarter of the total amount, dividends have been withheld.

If you happen to buy some stock from an acquaintance or locally through your banker, be sure and have the transfer made at once at the offices of the company by which they are issued, or its transfer agent, usually some trust company or bank. If you buy by application to the particular corporation's brokers or bankers, this transfer should be taken care of in all cases. Having your shares transferred to your name and thus registered insures immediate participation in the dividends as declared.

It is always better to buy outright if you have the money ready, as the matter is thus disposed of as one transaction. But where you are anxious to secure a number of shares at the then price, on which you fear there may be an advance, then by all means secure the number for which you can afford to pay in the specified time, by two or three installments.

Having bought shares in a great public service or public utility corporation at a high price, in times of activity in the stock market and when business sentiment is optimistic and all markets are strong, do not let go and sell out because there comes a time when the price shrinks. The stock of such corporations is always good as long as the management is efficient and honest, and in these days it has to be. At the time of the 1907 panic it was the stocks and securities of the great public service and utility companies that showed the lowest shrinkage, and their business, following natural conditions, in most cases continued to increase, so that they had much cash coming in at a time of prevailing dearth and shortage.

The price of bonds varies, as a rule, but a few points in the case of the larger electric undertakings, and most of them have excellent security and value behind them.

A few words as to the rate of interest on bonds will be in place here. Great estates, life insurance companies and other large investment institutions are still good buyers of low interest yielding bonds, but the average investor wants more, and he is getting it from the class of high grade public utility, municipal and industrial bonds now on the market. Moreover, dealers in investment securities are beset at this time with demands for "safe investments

yielding not less than five per cent." A few years ago safety and five per cent were considered almost incompatible, especially the degree of safety suitable for women, but nowadays five per cent appears to be the minimum of income demanded. The request for a list of safe securities yielding five per cent or more is repeated in every banking house. For a long time brokers said it was impossible to furnish it. A list of five per cent investments was not a list of absolutely safe investments, but the demand persisted and was met partly by new issues and partly by the decline in the prices of old securities, but mainly by the advent of the securities of the big, strong utility and public service corporations, so that now when an investor wants five per cent with safety he has a big selection from which to choose. Hundreds of five per cent lists may now be had, and in these incomparably the best companies named are the public utility and service corporations. And this steady demand for the five per cent bond brings naturally to the question of—"What to Buy?"

The answer is ready and is absolutely convincing. Buy the bonds of those companies giving public service or supplying the public with necessaries, particularly the securities of those companies doing business in a territory where there is a constantly increasing population, and in places where there is concentration of population at many points, for the public service company, the public utility company, or even the industrial company supplying public needs has an ever growing source of revenue if its business is at all properly managed.

Municipal bonds of a high grade character, and that is to say such issues as have been tested by experts in their relation to their respective municipalities' revenues, and have then been brought out by reputable bond houses, are equally desirable.

A progressive future is before such corporations, and your income is as secure as the "Rock of Gibraltar."

As to the general outlook at this present time—and never forget that the present makes the future—the British Chancellor of the Exchequer, Mr. Lloyd George, one of the ablest and brightest business heads in the world, in forecasting his budget for fiscal plans for his government for this year, referred, only a few weeks ago, very pointedly to the prospects in the United States as well as in the British Isles and to the future of international trade. His most convincing speech indicated that, in the opinion of those best posted and most certainly familiar with business and trade conditions the world over, there was nothing but satisfactory readjustment of all existing obstacles to renewed and continued prosperity for both nations ahead of us.

This, too, is the conclusion of the writer of these "Contango" articles. There is no time like the present in which to get the advantage of reasonable prices for both the stocks and bonds of those great electrical undertakings, which, of all utility companies, have the greatest certainty of development.

A New Use for Tungsten

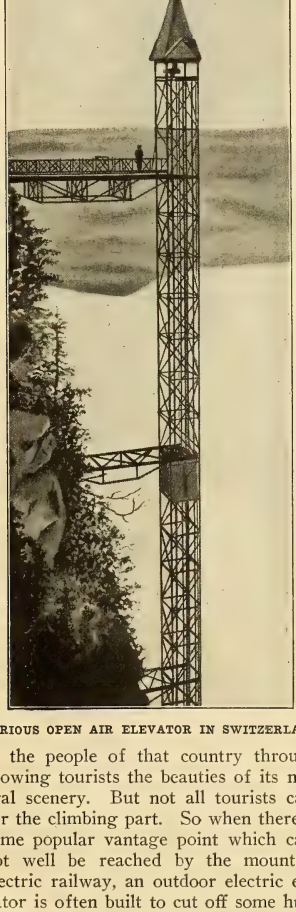
Tungsten, which has become so well known through its use in metallic filament electric lamps, promises to find many useful applications in the industrial field. One of its latest applications is in replacing platinum on the contact points of induction and spark coils. It has a high melting point and is found to be much cheaper and many times more durable than platinum. Experiments are being conducted on tungsten points for spark plugs which promise great success.

An Automatic Wheelsman

A device for automatically steering a boat has been long sought for and has been the subject of much thought and invention. One device of this kind seeks to make use of the compass needle, through an auxiliary circuit, automatically to open and close the circuit of a motor which swings the rudder.

An Outdoor Elevator

This interesting view was taken at one of the mountain lakes of Switzerland. As is well known, much profit results



CURIOUS OPEN AIR ELEVATOR IN SWITZERLAND

to the people of that country through showing tourists the beauties of its natural scenery. But not all tourists care for the climbing part. So when there is some popular vantage point which cannot well be reached by the mountain electric railway, an outdoor electric elevator is often built to cut off some hundreds of feet of difficult climbing.

Miniature Motion Picture Machine

At a recent demonstration in the Minneapolis schools, motion pictures were shown, produced by a miniature machine, that were complete reproductions of "The Battle of Trafalgar," "The Declaration of Independence," "Niagara Falls," "The Cocoa Industry," "Magnetic Lines of Force," and other subjects of educational nature.

The machine itself is a complete model of the larger machine and has a regular hand feeding arc. The carbons used for the arc are only a trifle over ¼ inch in diameter and are cored and copper coated. The machine can be used with slides as well as motion films.

The chief novelty appears to be in the film, which is fire proof and which contains as many pictures in 80 feet as the regular film has in a reel 1,000 feet long. The pictures are only about ¼ by 3-16 inch in size and arranged in three rows on the one film. The two outer rows face in the same direction but the middle row faces in the opposite direction. The machine has an arrangement for shifting the light onto the rows separately.

Starting from one end the film is wound with the outer row in front of the light until it reaches the end. It is then shifted to the middle row and the direction of winding reversed. When the end is again reached it is shifted to the outer row and the direction of winding is again reversed. In this manner the three rows are made practically continuous. Some of the larger films last about eighteen minutes, the same as the regular films. The projected picture is about four by six feet and is very clear.

It is difficult for the layman and the student to get a clear idea of magnetic lines of force for the very reason that they are invisible to the eye. In fact, it is not definitely proved that these magnetic lines take the shapes which are given by the modern theories.

A thorough understanding of the mod-

ern theories is essential to an understanding of practical electricity. With this end in view a series of moving pictures have been prepared by the Edison company to show the magnetic lines in motion exactly as the modern theory demands.

The film is one of these new Edison miniature films. First a magnet is shown with a keeper moving to it and then a hand pulls it away again. The expanding and increasing magnetic lines are shown in a striking manner. In a similar manner, the lines of force about a wire, an alternating current magnet, a motor armature, a dynamo field and the Hertzian waves used in wireless telegraphy, are all shown. The lines are shown in motion and convey a lesson which is not possible in any other manner.

The pictures were produced from a great number of drawings and are quite remarkable.

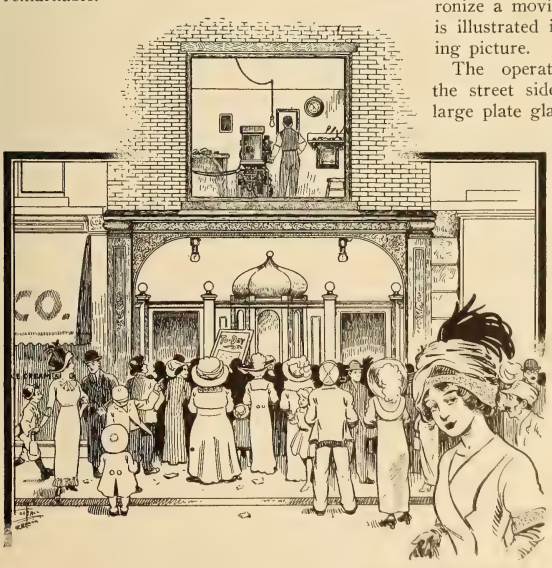
Street Cars to the Leaning Tower

An electric street car line has just been constructed in Pisa, Italy, where the famous Leaning Tower is located. The building of the car line has long been bitterly opposed by local cab drivers, who immemorially have depended for their livelihood upon carrying tourists to the place where are located the world famed tower and a number of other celebrated structures. As the street car fare will be only two cents, it may be expected that some of the hackmen will be forced into other channels of industry.

Two Shows in One

A most unusual and effective scheme for attracting the passing public to take note of "Today's Program" and to patronize a moving picture theater is illustrated in the accompanying picture.

The operator's booth upon the street side is fitted with a large plate glass window. With the booth lights on as they always are during the show the movements of the operator can be easily seen from the sidewalk below. At all times while the theater is open a crowd may be seen watching the "free show" and a goodly number always become interested enough to part with a nickel to see the "inside show."



MOVING PICTURE OPERATOR IN FULL VIEW OF THOSE ON THE STREET

A PENNSYLVANIA FARM ELECTRIFIED

Electricity has been harnessed to a surprising extent by William Hazard at his home in Fallsington, Bucks County, Pa. He uses it as a motive power for

IN THE WASH ROOM JUST AFTER A BIG DAY'S WASH

work around the house and barn and the neighbors are calling his establishment the "Electrical Farm." Mr. Hazard took up the study of electricity after retiring from active work and has accomplished results through his own efforts.

In his house he has an electric stove and bake oven, and if coffee is wanted quickly there is a coffee percolator, and there is also a small stove to cook eggs, cakes, etc. Another step saving device is an electric dumb waiter running from cellar to top floor for small articles. The sewing machine has a motor and there are electric lights throughout the house, electric fans, and an electric vacuum cleaner.

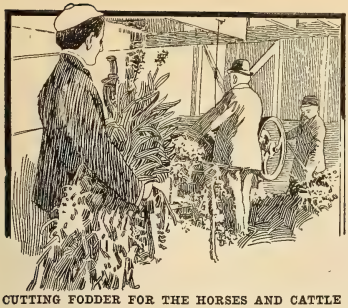
In the large wash house the washers, wringers, etc., are entirely operated by electricity, and Mr. Hazard says, "The washing machines have saved enough money to pay the interest on my whole investment."

The great advantage which Mr. Hazard has in his homemade plant is seen in the conveniences in the barn. He can shell, crack and grind his own horse feed, cut corn, corn stalks and hay and the same motor is also used to lift the hay into the barn from the hay wagon.

"In most barns and mills," says Mr. Hazard, "there is required much line shafting to get all the machines onto the engine, or else the inconvenience of moving the machines to the engine is involved. Here I have everything so as to get current direct. A small motor placed in an out of the way place can be used to run as many different kinds of machines as you have room to use, and your power is always direct from the power source."

His latest hobby is a wireless station. The mast stands 78 feet in the air, and messages can be taken from stations ten and twelve hundred miles away. He has caught messages from ships many miles

THE ELECTRIC IRON IS APPRECIATED IN THE FARM HOME



CUTTING FODDER FOR THE HORSES AND CATTLE

at sea and also from several inland stations.

The power plant is in the cellar. There are 70 cells of storage battery, 62 cells being in series with eight end cells for regulation. The eight regulating cells are to keep the voltage uniform at 110 volts.

The engine which Mr. Hazard uses for running the dynamo for charging the batteries is an especially constructed Fairbanks-Morse engine for running electrical machinery. He started his plant with a few storage batteries and a few lights, and kept on increasing until he now has the only plant of its kind in western Pennsylvania. He says the plant is only in its infancy as he intends to have everything complete before ceasing the work. In his opinion if the farmer of today cannot increase his profits 100 per cent through improved methods there must be something wrong.

Telephone Dispatching System for Taxicabs

It has long been recognized in the taxicab business that the principal source of loss lies in long hauls without passengers. To eliminate this leakage in revenue the Pittsburg Taxicab Company has originated in this country for the first time a system of taxicab telephone stations which are distributed over the territory served by the company. These sets are built much after the style of the ordinary patrolmen telephones which are a common sight now in all of the larger cities.

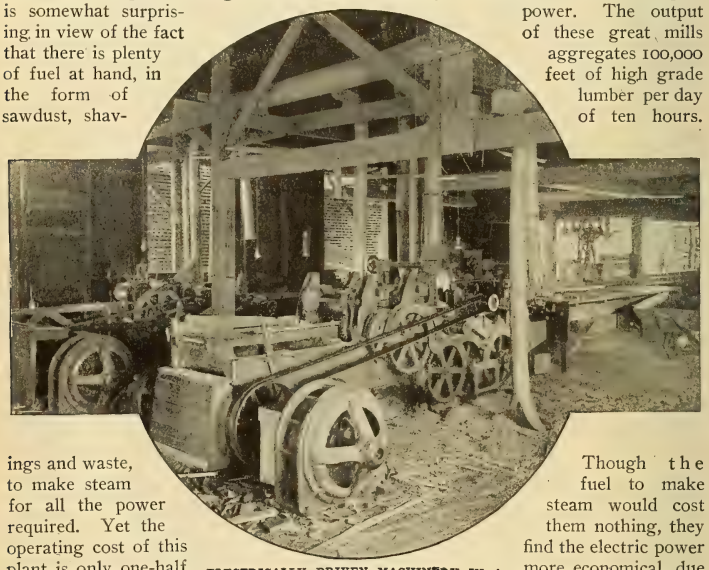
They are weatherproof and consist of a ringer and combination receiver and transmitter mounted in a locked iron case. Twenty-one of these stations are installed throughout the city of Pittsburg and its suburbs for the exclusive use of the taxicab drivers. In the system in practice before the adoption of the taxicab stations a passenger making a four mile trip to one end of the town would pay his fee and if the car on its return was not flagged by a chance fare the return trip would have to be charged up to loss by the company. With the adoption of the present system, however, the cars are run much as a well regulated steam railroad. The wires from

AT THE FARM PLANT SWITCHBOARD

the 21 stations of the company converge at the main office of the company in a switchboard at which a special operator constantly stays on duty. Here a record is kept of each taxicab, where it is bound for, the fare, and distance. When the passenger is delivered, the chauffeur calls up the central office at the nearest taxicab station and finds out from the operator the nearest return fare. He secures his new fare and delivers him, calls up the office again and learns of the nearest third passenger who has telephoned and so on.

Electricity Cheaper than Steam in Seattle Mills

In Seattle, Wash., one of the largest sash and door factories in the city is operated by electric power, from the Seattle Electric Company—some 400 electrical horsepower being used. This is somewhat surprising in view of the fact that there is plenty of fuel at hand, in the form of sawdust, shavings and waste, to make steam for all the power required. Yet the operating cost of this plant is only one-half of what it would cost to operate with steam or any other source of power, and the maintenance cost is practically nothing, amounting to less than $25.00 per year, which is a record hard to beat. In a plant like this there are a great many machines that are not continuously in use, and with the direct connected motor drive it is very convenient to close a switch, start the machine and open it to stop when through. Another great advantage is that there are no belts in the way, no shafting to be getting out of line, and the machines may be spotted on the floor at any angle desired.



ELECTRICALLY DRIVEN MACHINERY IN A SEATTLE MILL

The refuse such as shavings and sawdust, other than that required for producing steam for dry kilns, is sold for commercial purposes, the sawdust going to a chemical factory.

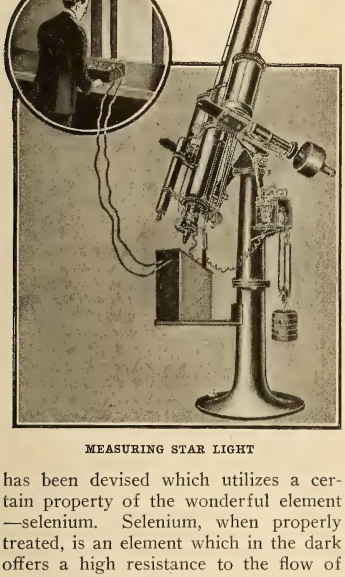
Similarly in the cases of the Balcom and the Canal Lumber Company mills, electricity is found to be the cheapest power. The output of these great mills aggregates 100,000 feet of high grade lumber per day of ten hours. Though the fuel to make steam would cost them nothing, they find the electric power more economical, due to the low maintenance cost and greater flexibility of operation of the electrical machinery.

Beefsteak by Wire

A New York restaurant has abandoned the shouting of orders to the chef and has installed a telegraph system. The waiter takes your order, and then signals it back on a small clicker where the message is caught by a man in the kitchen. The regular telegraph code is, of course, not used but one better suited to the needs of the restaurant has been devised.

Measuring Starlight

Nearly all the measurements of the brightness of our heavenly bodies have heretofore been dependent on the observations of the human eye or the photographic plate. Recently a new method



MEASURING STAR LIGHT

has been devised which utilizes a certain property of the wonderful element —selenium. Selenium, when properly treated, is an element which in the dark offers a high resistance to the flow of electric current, but when illuminated it becomes a much better conductor of electricity. The selenium cell, as the instrument is called, is made by winding two parallel wires on a flat insulator. The wires are kept separated by melting selenium on their surfaces and then baking the cell at a temperature below the melting point of the selenium.

The usual procedure is to place the selenium cell in the focus of a telescope. The cell is contained in a light-proof box provided with a photographic shutter. When the measurement is taken the shutter is opened for a few seconds and the cell is illuminated by the light from the star whose brightness is to be determined. The increase in the flow of electric current through the cell when illuminated is measured with exceedingly accurate instruments, and by comparison with measurements on objects of a known brightness the unknown brightness is readily obtained.

Stars are classified according to their "magnitude," which is determined by their brightness. By this method the light from any star can be focused on the selenium cell and a direct measurement of its brightness can be made. The method has also been used to study eclipses. It is especially valuable in determining the exact middle or maximum of solar and lunar eclipses. Measurements of the variation of the moon's light throughout the year have been studied. As an example of the measurements on the variation of the candlepower of the moon during its various phases it was found that the brightness was nine times greater at full moon than at half moon.

Some Odd Facts About the Telephone

Eight million miles of wire have been added to American telephone systems in five years.

Iowa, Nebraska, Washington, Nevada and California lead the states in number of telephones to population.

Texas sends more messages per capita than New Jersey; Utah is ahead of Pennsylvania.

Cleveland is the city with the most telephones to every thousand inhabitants; New Orleans the least.

In Chicago the company has 60,000 requests daily for the time.

The busiest hour on the telephone exchange is between 10 and 11 a. m.; the busiest day in the year, the day before Christmas.

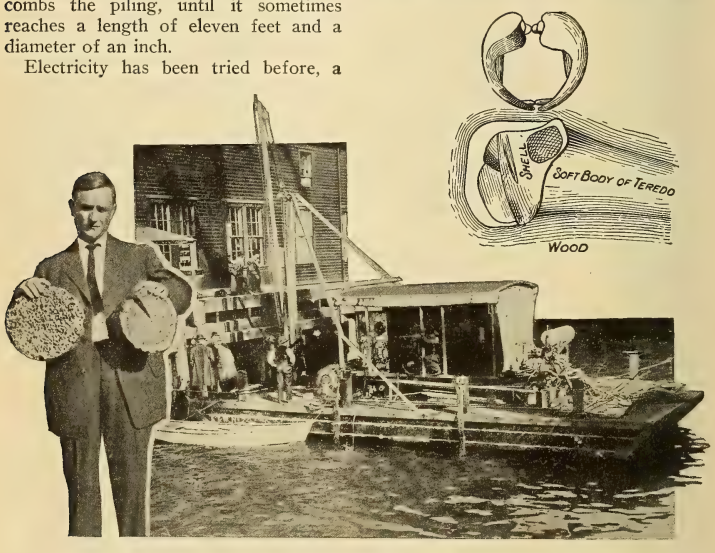
Five office buildings in New York have telephones enough for a city of 100,000 people.

Floating Power Plant Protects Piling

Electricity has solved another problem of great importance to commerce by affording protection for wharves and docks against the destructive teredo and other marine borers which destroy piling. The man who is not closely connected with marine business has no idea of the alarming ravages of this bivalve, a tiny threadlike creature which is almost invisible when it first attaches itself to pier timbers, but which burrows into the wood and grows greater as it honeycombs the piling, until it sometimes reaches a length of eleven feet and a diameter of an inch.

Electricity has been tried before, a current being passed through the infested piling to destroy the borers, but it was expensive, dangerous on account of the fire risk, and ineffectual, for the reason that the teredo as it eats into the wood secretes a calcareous matter which is deposited on the surface of its winding burrow, thus forming a natural insulation against electric shocks.

But a novel application of electricity has recently been devised by Prof. George Delius and Mr. Charles Pembroke Tatro, of Seattle, which finds the vulnerable point of the teredo. It destroys the borers by electrolysis, using the following ingenious method: A floating power plant is installed on a barge, carrying from 20 to 40,000 amperes at very low voltage. This is brought close to the piling to be treated, the wharf having been wired, and electrodes (of cheap cast iron) having been suspended in the sea water under the wharf. When the current is turned on the effect of the electrolytic action in salt water is to release large volumes of deadly chlorine gas. As each cubic inch of gas will permeate four cubic feet of water to the extent of destroying the



AN EXAMPLE OF THE WORK OF THE TEREDO AND THE UNIQUE POWER PLANT PLANNED FOR ITS DESTRUCTION

teredo and other wood borers, the method is highly efficient. No teredo within the affected zone escapes alive, no matter how deeply it may have bored into the wood, as the gas reaches every burrow, and not only destroys the life of the teredo but coagulates its body to the consistency of a soft boiled egg.

The treatment must be repeated at regular intervals, which will differ according to the locality. In tropical waters the teredo works very rapidly and grows with alarming speed, while in cooler latitudes its destructive efforts are slower. However, while this treatment must be regarded as an upkeep charge in wharf maintenance, it is not expensive compared to the replacement of piles at frequent intervals, to say nothing of the danger of accidents from insecure dock supports. As an example of this danger, it will be recalled that a few years ago the dock at the foot of Broad street, Seattle, fell into the water only two years after it had been built. Its creosoted piling had been eaten by the teredo.

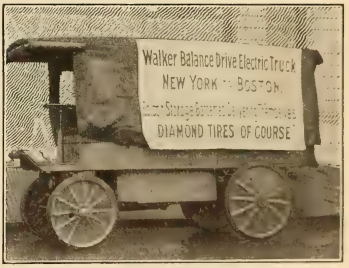
Toned Telegraph Signals

In England there is coming into use a method of telegraphing in which the operator sends signals by his key, but at the other end of the line there is used only a telephone to take off the messages. The method differs from the usual Morse signals in the use of a high and a low musical note in the line, so that each high note signal represents a dash and each low note a dot. Thus the letter "A" on the usual code is a dot and a dash, and "B" a dash and three dots, while on the new method "A" is a low note signal followed by a high note, "B" is a high note followed by three low note signals. Seeing that all the signals are now of the same length, that is, only dots are used, it takes less time to send the messages, as the dashes take up three times the length of the dot, and we thus have a saving of about 27 per cent of time, which is quite an item. Another point is that the signals are much clearer, and when there is trouble on the line for any reason, it is easier to read off the messages, and mistakes are not as likely to occur. The present apparatus is designed by Mr. E. Raymond-Barker, a London engineer. Two vibrating tongues set in movement by electro-magnets are used, and one of these gives the high musical note and the other the low pitch. The operator works two keys so as to put in one or the other note.

Electric Truck Makes Record Run

A run from New York to Boston, a distance of 252 miles, in 21 hours actual running time, is the record of the Walker balanced drive truck shown in the picture. During this trip only two charges of the Edison cell battery were made.

The driving mechanism of the car is particularly interesting, as all of the motive parts are in the rear axle and the rear wheels, with the exception of the batteries and the connecting wires. The motor on the rear axles has a direct drive to two pinions running to idler gears in the wheels. These latter engage in teeth in the extreme rims of the wheels, propelling the car by this means.



ELECTRIC TRUCK THAT MADE 252 MILES IN 21 HOURS

The car weighs 3,000 pounds and the load brought from New York weighed 2,800 pounds, to which was added the weight of two men.

The Casino Technical School for Women

By R. J. WATSON

All over the country we hear of various methods by which large industrial corporations are seeking to help those of their employes who wish to help themselves. Located in the vicinity of the Westinghouse interests of the Pittsburgh district, the Casino Technical Night School is carrying on several courses of training, not the least important of which is a department for women.

The course of instruction now embraces stenography, typewriting, cooking, sewing, music and preparatory work in the common school branches, the aim and object being to give a fundamental training in these lines and to give the student a broad view of her work and its relations to the various activities of life.

Classes meet Monday and Wednesday evenings of each week from seven to nine o'clock. There are two terms of four months each in the school year.

The work in stenography is designed not only to give the student the speed and accuracy essential to successful work, but to train her also to use thought and judgment in her work, to become familiar with business terms and practices; in short, to be self-reliant.

The instruction in cooking is designed to give a practical knowledge of plain cooking and the serving of simple food. The economy of buying, both in regard to quality and quantity; the use of material, especially of food materials that are often thrown away, is emphasized as essential to good housekeeping. The classification of foods, their composition, and the chemical changes which take place by the application of heat and moisture, and the best methods of cooking food to preserve the nutritive value in the most digestible form, are some of the things aimed at in this course.

Instruction in the fundamental points of sanitation in connection with sinks, drawers, garbage cans, etc., is attested by the scrupulous cleanliness.

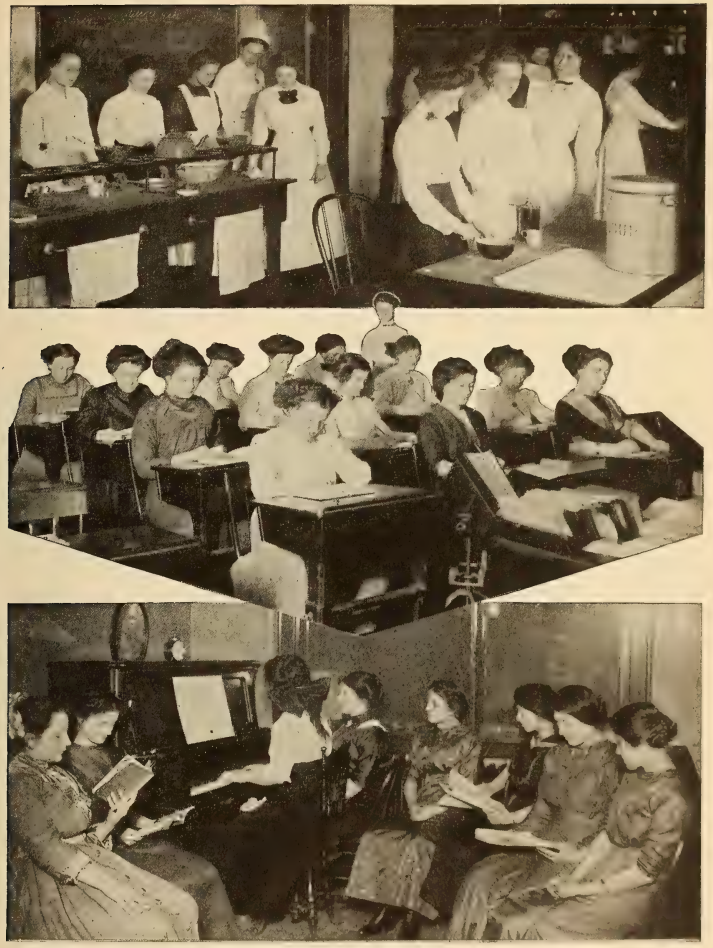
The instruction in sewing embraces both hand and machine work. In the beginning, simple garments, such as small sewing aprons, are made, and as the student progresses, more difficult work is undertaken. The idea is to give a thorough knowledge of the fundamentals of sewing and to guide the girl in her taste for dress so as to develop an individuality of style in keeping with her income.

Because of economic conditions in the homes, many girls are forced to leave school at an early age and seek employment. The Westinghouse Electric and Manufacturing Company alone employs over 1,600 women who are engaged in the various occupations of winding and taping electrical apparatus, etc., as well as in clerical positions. The night school offers a preparatory course in the common school branches to all who have not previously had such training.

Last, but not least in importance, is the course in music. Piano and voice are taught, the choice of which is optional with the pupil. The aim is to give a general knowledge of good music, to cultivate an appreciation of and a desire for the better class of music, and to reach a certain proficiency in piano playing.

The subject of cost is one that naturally arises. In this case it has been put within the reach of all, for those who are in charge and have the welfare of the community at heart believe that the individual rarely wishes a gratuity, and appreciates most that which can be purchased with his or her own efforts. Tuition per term of four months is as follows:

Cooking and sewing	$5.00
Stenography and typewriting	5.00
Music	3.00
Cooking only	3.00
Sewing only	3.00
Preparatory department	5.00



COOKING CLASS, ENGLISH CLASS AND MUSIC CLASS IN THE CASINO TECHNICAL SCHOOL FOR WOMEN. THESE COURSES ARE SUPPORTED LARGELY BY ONE OF THE GREAT ELECTRICAL MANUFACTURING COMPANIES WHICH IS SEEKING TO HELP ITS EMPLOYES TO HELP THEMSELVES

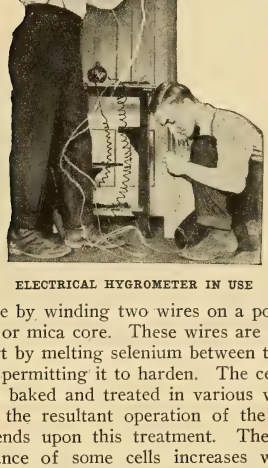
The income from tuition pays about one-half of the expenses of the school. The balance is made up by contributions from the Westinghouse Electric and Manufacturing Company. In addition to the tuition, the students are put to a

small expense for pencils, paper, tablets, needles, patterns, sewing materials, music, etc. It must be borne in mind that all articles made in the sewing department become the property of the student and time and material are not wasted in making useless niceties or articles that can not be worn.

The social side of life is not neglected. The school has a regular lecture course, which is free to the students and their friends. Once a month a social hour is provided when all the students assemble in the auditorium, and recitations, music, and general sociability hold sway.

An Electrical Hygrometer

Selenium is a substance which through its peculiar properties is being used in many unique processes. The electrical resistance of this element changes when illuminated by light. Selenium cells are



ELECTRICAL HYGROMETER IN USE

made by winding two wires on a porcelain or mica core. These wires are kept apart by melting selenium between them and permitting it to harden. The cell is then baked and treated in various ways and the resultant operation of the cell depends upon this treatment. The resistance of some cells increases when illuminated, while in others it decreases.

Another interesting property has recently been discovered; namely that the resistance of a selenium cell changes with moisture. Immediately it became evident that the selenium cell could be used as a hygrometer to detect the amount of water vapor in the air. Experiments have shown that the instrument will indicate humidity with considerable accuracy when precautions are taken to standardize conditions. The selenium cell will readily lend itself for use as a regulator of moisture in the air in buildings. Modern buildings are equipped with apparatus controlling the amount of water vapor in the air and as the selenium hygrometer is an electrical device it will be possible to make the hygrometer automatically control the humidifier.

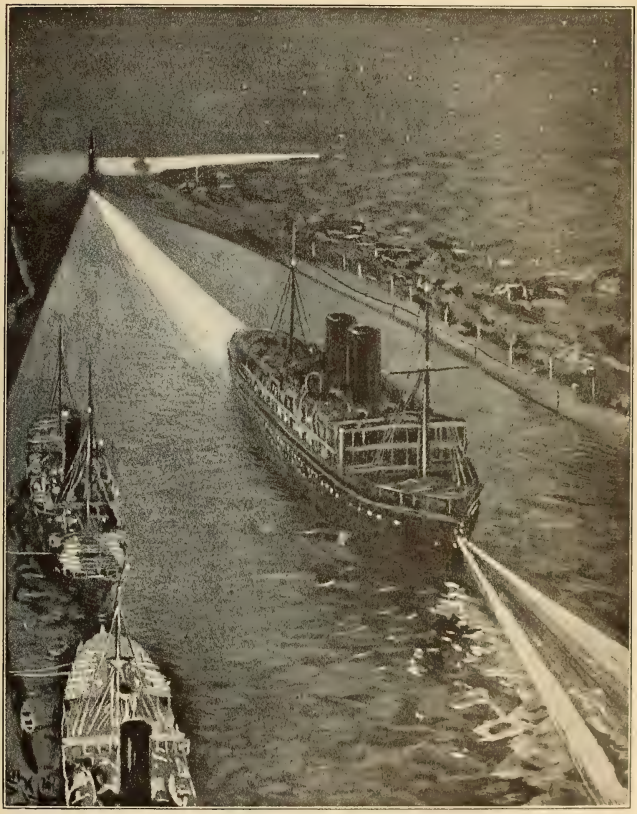
Again a practical instrument has grown out of a scientific toy.

Death of Prof. Antonio Pacinotti

Prof. Antonio Pacinotti, original inventor of the direct-current dynamo with its commutator and of the ring and toothed types of armature, died at Pisa, Italy, on March 24.

Professor Pacinotti was born in Pisa, Italy, June 17, 1841. Under the direction of his father he early began the study of electro-magnetism, and by the time he was seventeen years of age had the principles of the direct-current generator well in mind, constructing in 1860 the celebrated machine which ten years later was reinvented by Gramme. After three years of experimentation with his models, Pacinotti published an illustrated description of his dynamo in the *Nuovo Cimento* in 1864, but this received little attention at the time.

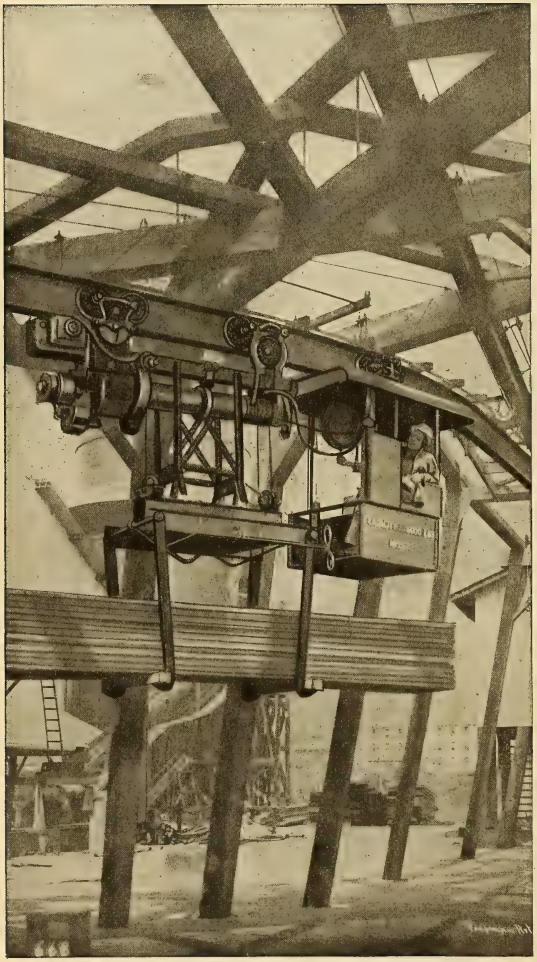
It was not until 1873 that he exhibited, at the Vienna Exposition, the dynamo model which he made in 1860. He then, for the first time, received wide credit for his invention, interest in which had meanwhile been reawakened by the invention of the ring armature by Gramme, in 1870.



SEARCHLIGHT PILOTS OF THE NIGHT

In the Suez Canal a crude though effective arrangement prevails to light each vessel's way. Over the bow of the ship is hung a cage in which is an arc light and an operator. The blinding glare to the crew of an approaching boat is avoided by dividing the arc light's beam at the lamp by cutting off some of the rays and projecting a dark angle as shown in the picture.

MONORAIL SYSTEM FOR LUMBER MILLS



A RAILWAY ON STILTS THROUGH THE LUMBER YARDS

In the most up-to-date lumber mills and yards it is not unusual to find a sort of railway on stilts which meanders around through the various yards and into and out of the mills and drying sheds. It carries on its under side a single rail from which is suspended a monorail car driven by motors which derive their power from a trolley wire. In addition to driving the car along on the rail the motors also operate a drum which lowers or winds up grappling irons which can lift several tons of lumber at a load.

In moving lumber from one shed to another and in sorting out the various sizes the use of such a system results in a marked economy. One man in the little cage directs the motors in doing all this laborious work, making it possible greatly to reduce the cost.

Proving the Engineer Alive

Last summer quite a number of lives were endangered on one of our western roads when the engineer was stricken with heart failure in his cab and the locomotive kept thundering along with no one at the throttle. An inventor has since come forward with a practical solution of the problem involving this danger. He mounts an electric push button in the lever of the throttle so that the hand of the engineer will press on this button. Should the hand be withdrawn while the engine is going at high speed, an electro-magnet will automatically shut off the steam and set the brakes. At low speeds, or when the engine is standing still, the safety device is not connected in service and as it only requires a trifling pressure of the hand to keep the button operative, this would seem to be the simplest and most dependable way of watching the engineer to make sure that he is both alive and awake.

A Rat's Handiwork

This piece of lead armor was taken from a 400 pair aerial telephone cable and was found where the cable made its entrance to a building. The hole was cut by a rat which evidently sat on the messenger wire outside of the building to do the work—a clean cut, workmanlike job.

Courtesy of the Cumberland Telephone Journal

CABLE ARMOR GNAWED THROUGH BY A RAT

Individual Telephone Transmitter

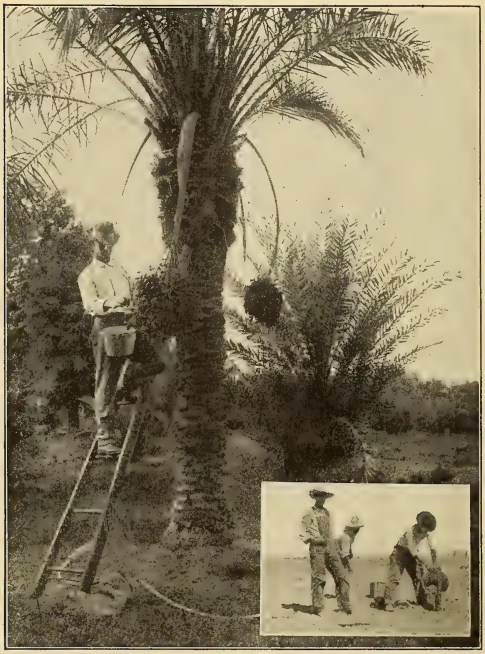
The unsanitary condition of the public telephone transmitter has led to the invention of a vest pocket instrument.

VEST POCKET TRANSMITTER AND ITS APPLICATION TO A SPECIAL DESK SET

The transmitter and collapsible mouth piece are contained within a watch case. On pressing a button the case springs open and a coiled spring within forces the mouth piece out into operating position. Two terminals are provided for connection to the telephone instrument.

Of course, where the ordinary desk set is in use there is no way of attaching the pocket transmitter. In this case it is proposed to provide a special set adaptable to its use. For instance, in a hotel or railway station one of the several booths might be provided with a special set so that travelers having their own transmitters could be able to use them.

Electricity Aids the Date Industry



HARVESTING DATES IN ARIZONA. IN THE LOWER PICTURE A YOUNG DATE GROVE IS BEING SET OUT

The date industry in our southwestern states is developing into one of importance, as large shipments of shoots from the African oases have been imported and set out in Arizona and Southern California during the past year. For several years the United States government has carried on experimental work at Tempe, Ariz., with various kinds of dates, but it was found that one of the most valuable varieties known as the Deglet Noor would not ripen in that climate under ordinary conditions. The summers, while hot, are not long enough to complete the ripening process with certainty.

Electricity has come to the date grower's aid, however, being employed in the artificial ripening of the fruit. The credit for this device belongs to Prof. George F. Freeman of the University of Arizona in Tucson. He has invented an electrically heated metal oven in which the dates are placed when they have ripened naturally as far as possible. The fruit is washed and "incubated" in these ovens for three days; a temperature of between 45 and 50 degrees C. being

maintained. This is not a dry heat, but sufficiently moist to keep the dates luscious and juicy. In fact the same treatment will restore fruit which has been allowed to remain on the tree until partially dried and withered, though in this case a preliminary soaking is required. The ovens treat 100 pounds of dates at a time.

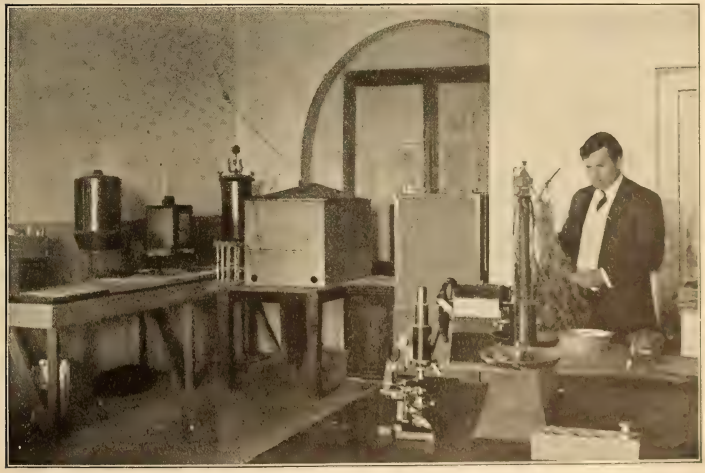
By this invention, which assures the date grower that his crop can be ripened for the market, the industry will be on a firmer basis. Already immense areas in the Coachella Valley of California and various parts of Arizona have been set out to dates. Shipments of the electrically ripened fruit have been exported to all parts of this country and to Paris, France, and have arrived in good condition. The fresh dates sell at from 30 to 50 cents a pound, and the demand is great.

Electricity Direct from Heat

To obtain electricity direct from heat is a dream which is likely at some time to be realized. At present there are numerous methods of obtaining electricity direct from heat but the power obtainable is very minute. However, a new method has been devised which employs two insulated carbon rods heated in an electric furnace or oxy-acetylene flame. The two carbons are kept separated at one end, but the other ends are connected through a current-measuring instrument. When one of the carbons is suddenly displaced a current of several amperes will flow. By displacing one of the carbons periodically an alternating current can be generated.

When a slight voltage is applied to the carbons the current increases to more than ten amperes at about 450° Fahrenheit.

These experiments are interesting inasmuch as such a result would hardly be expected at atmospheric pressure. The same phenomenon has been noticed before on a much smaller scale, but in a high vacuum. Such seemingly insignificant discoveries often mark the beginning of wonderful developments.



PROF. GEORGE F. FREEMAN AND HIS ELECTRICALLY HEATED OVEN FOR RIPENING DATES

Deaf Mutes' "Telephone"

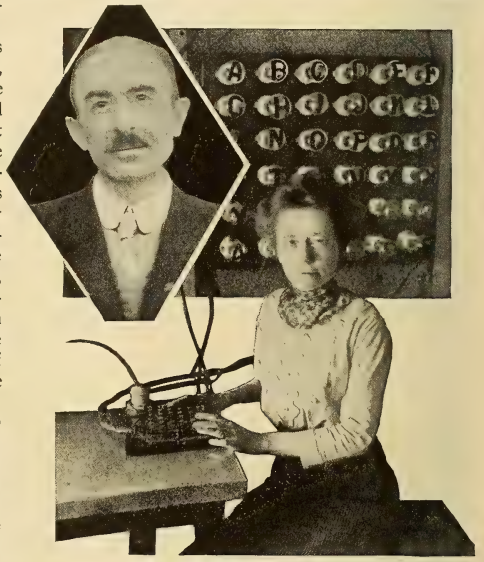
William E. Shaw, a deaf mute, of 11 Grove Street, Lynn, Mass., has invented what he calls a "deaf mutes' telephone," to enable them to converse rapidly not only with each other but with those who possess their sense of hearing and speech without the use of the finger sign language.

The "phone" comprises an electrical keyboard, something in appearance like that of a standard typewriting machine. It has, like a typewriter, the "universal system" or arrangement of letters. This keyboard is connected by wire with the electric signal board, which is the talking machine proper, consisting of 36 incandescent light globes, each painted on the end of the bulb with a large letter of the alphabet or one of the numerals.

The deaf mute who wishes to talk with another person presses the keys in order, spelling out the words as on a typewriter, his vis-a-vis reading off the letters as they flash up on the lamps. The keys come down onto points of contact in the same manner as the printing-typewriting telegraph machines, instead of striking by means of a lever bar as does a typewriter key. This does away with any false or lost motion and insures perfect contacts. But the keyboard can be operated as quickly by an expert as an ordinary typewriter, and the letters can be read as quickly as they can be flashed up.

Mr. Shaw has perfected his invention so that two machines may be installed in separate rooms or houses some distance apart and the conversation carried on swiftly and silently. Two machines may even be connected up over an ordinary telephone line and conversation carried on at any time, the line being left open for signals.

Mr. Shaw is employed by the General Electric Company and has made several other inventions for deaf mutes, including an alarm clock, where electric lights take the place of the customary bell, and a door signal for houses of deaf mutes.



DEAF MUTES' TELEPHONE, WITH THE INVENTOR WILLIAM E. SHAW AND HIS WIFE

United States Asbestos Production Doubled

Asbestos is important as an electric insulator and in the electric fireless cooker serves as an excellent non-conductor of heat. It is a matter of interest therefore to note that in the year 1911 the production of asbestos in the United States more than doubled. Vermont and Georgia produced nearly all of 7,604 tons valued at $119,935.

Portland Regrade Operation

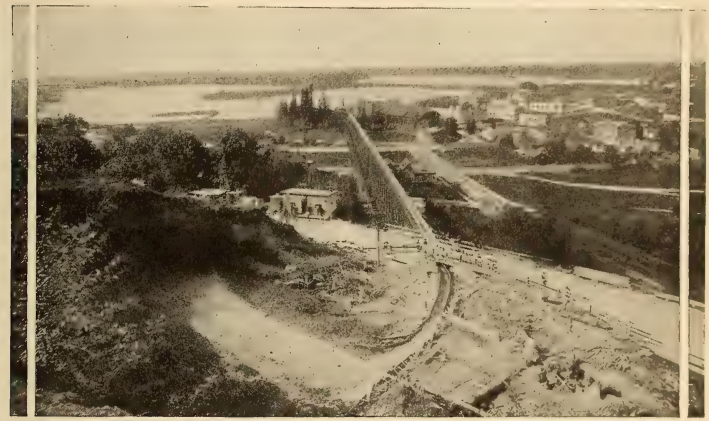
It is well known that Seattle, Wash., has in recent years veritably remodeled herself. From a city of steep hills she has been changed to one of gentle grades. This great project was eminently successful, largely because of the use of high grade modern electrical and mechanical hydraulic apparatus.

Portland, Ore., 200 miles to the south, noticed the miracles being worked in Seattle and is now following suit by hydraulically reducing an abrupt prominence within her limits, known as Goldsmith's Hill. Because of the great satisfaction given by the motors used to operate the pumps which washed the hills of Seattle into the sea, these same motors were later taken to Portland, where they are now being used to drive the pumps in the regrading there.

The composition of Goldsmith's Hill is especially gravelly. The streams, therefore, are directed by huge nozzles so as to undermine the lower part of the bank, and the weight of the material above brings down the sand and gravel from the working face. From here it is washed into Guild's Lake.

The trestle supporting the sluice through which the debris is conducted to the lake also supports two eighteen inch pipes carrying the water pumped from the same lake.

The pump house, a temporary structure, of course, is located near the lower end of the trestle. Its foundations were laid in the bottom of the lake at low water before any filling had been done. Now, however, the pump house is in the middle of a filled tract of several acres.



REMOVING GOLDSMITH'S HILL AND DUMPING IT INTO THE LAKE.

It is expected that by the spring of 1913 the so-called Goldsmith's Hill will be no more and that its site will be suitable for no less than 300 residences, while the operation will reclaim to the city several acres of land from Guild's Lake, half a mile away. The project is, therefore, serving a two-fold purpose.

The pumping plant, driven by great 650 horsepower Westinghouse motors, is capable of supplying 500,000 gallons of water an hour at a pressure varying between 200 and 300 pounds per square inch, according to the demand. Electric energy is supplied by the Portland Railway, Light & Power Company's plant.

How to Become a Telegraph Operator

By AN OPERATOR

In the old days the only way to learn to be a telegraph operator was to work as a messenger in a telegraph office and rely on the generosity of the operator to teach the dots and dashes. Many operators would do this for a small sum of money. However, progress in this manner was always slow and generally took several years before it was possible to hold a position. There are also operators who will claim that they taught themselves. Maybe they did, but if they did they wasted many years before it was accomplished. The only practical and thorough way to learn telegraphy is to enroll in a good school. In regard to enrolling, investigate thoroughly the school you want to attend. Talk with the students, talk with the graduates, look up their guarantee, then if satisfied enroll and your career as an operator will be started.

Let us take, for example, the Jones School of Telegraphy, the official school of the Western Union Telegraph Company, Chicago, Ill.

The student is placed in one of the class rooms at a table with other beginners. He is then instructed by one of the school's instructors, and spends his time in learning the Morse code, and how to make the letters. The school is open both day and night, and students can attend either class. Students who are required to work while learning can obtain positions as clerks with the Western Union at from $25 to $35 per month. This does not require any previous knowledge of the work.

After the student has learned the Morse code and can make the letters without hesitation, he is graduated to another table, where he begins to practice sending and receiving. Regular telegraph messages which have been transmitted over regular wires are used. In this way the student becomes accustomed to handling telegrams and also learns the method of putting them down right.

As the student progresses, he is changed to tables doing faster work. When the student can send and receive at a fairly good speed, he starts copying from the wire with a typewriter, "mill" as the operators call it. This requires a lot of practice, as it is necessary for an operator to be a first class typist. This is absolutely necessary to obtain a position. Typewriters are furnished free by the school for the use of the students. As there are main line wires running through the class rooms of the school over which actual commercial messages are being sent, the student finishes up by copying from these wires. This gives the best practical experience possible.

When the student is able to send and receive at not less than 30 words per minute, and is able to turn out good copies from the typewriter, he is instructed in the managing of a branch office, how to look up rates, route messages, handle branch office switchboards, etc. When he is fully trained in these things he is ready for a position.

The first position given to commercial students is generally that of operator in some small town. Many operators are sent to Rockford, Elgin and Joliet, Ill., Racine, Wis., Cedar Rapids, Ia., etc. The average pay of these positions is $55 per month. From any of these positions the operator is promoted to a larger office in another town, where he will probably get $60 or $65 per month. Many operators come back to Chicago and work in the main office of the Western Union. Here they receive from $60 to $70 or more, depending upon their ability.

First class operators generally get about $80 per month. Operators on

overland wires are paid $90 to $100 per month. The positions of assistant division chief, division chief, switchboard man, wire chief, assistant chief operator, chief operator, etc., are always there to smart progressive operators in both day and night shifts.

The Illinois Central Railroad Company has opened a school for the purpose of qualifying operators for positions as railroad operators and station agents. This school has made arrangements with the Western Union school to accept all graduates for this course absolutely free. The student must be able to send and receive 20 words a minute. While in the Western Union school he is instructed in taking and sending train orders, etc.

This school of the Illinois Central offers exceptional opportunities to those desiring to become railroad operators. To this railroad school the company has assigned one of its experienced agents as instructor, and his entire time is taken up in instructing the students in the routine of station work. Students work eight hours a day, five hours are devoted to actual station work and three hours to copying from main line telegraph wires, practicing on train dispatcher's telephone equipment, and to telegraphic practice work on a local telegraph circuit. Each student receives individual instruction, and his advancement toward graduation depends solely on his attention and ability. The time required to complete this course is about four weeks.

After a student has qualified in this course of study, he is placed in a position as a station agent's helper on a salary of at least $25 per month. Here he remains for about three months. From the position of station agent's helper he is promoted to the position of scheduled telegrapher at a salary ranging from $55 per month upward, or agent at one of the smaller stations where the salary and commissions usually amount to $50 per month or more. The opportunities for the young man entering the field of station service are many and very desirable. The opportunities of the railroad operator are to be envied. He is actively engaged in railroad work at all times, and is always familiar with the managing of trains, etc. In fact, he has the best position for learning railroading. The positions of train dispatchers are filled from the ranks of the operators, and these salaries are very high. Railroad operators average $75 a month.

Walking on a Magnetized Floor

A "magnetic floor" is one of the latest amusement devices in Paris. The persons who walk on it wear shoes with iron soles and as the floor can be magnetized or not by throwing on switches they will

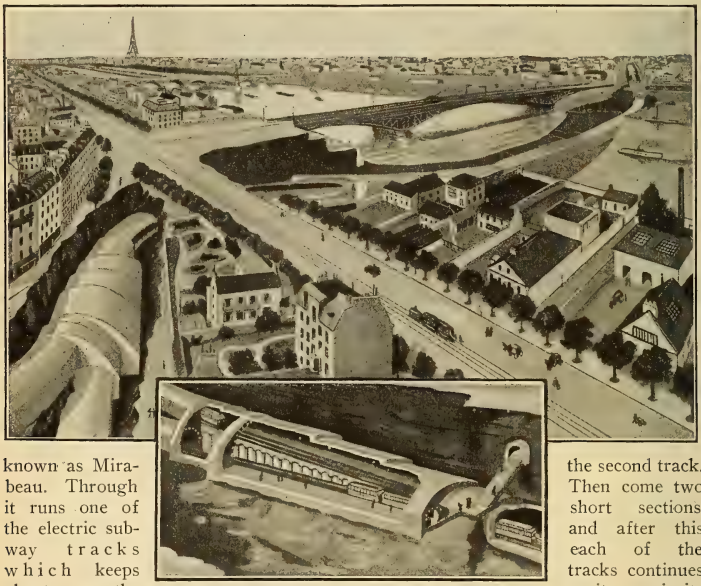
THE MAGNETIZED FLOOR

sometimes stick fast to the floor and at other times walk with perfect ease. By manipulation of the switches, the operator can produce the most grotesque actions on the part of the walkers.

The construction is quite simple and consists in the use of iron beams running along parallel, with wood strips between, so as to make up the floor surface. Between the iron beams are electro-magnets and these are spaced at the right intervals so as to have the floor well magnetized over all its parts. Switches are used in the circuits of the magnets so that all or any number may be energized.

Unusual Feature of Paris Subway

A somewhat original piece of work in the way of subway construction is being carried out on one of the new Paris lines at a point lying near the Seine. Here is located the subway station known as Mirabeau. Through it runs one of the electric subway tracks which keeps about on the same level and serves to take passengers from the station platform. Alongside it is a second track, but what is peculiar is that this track enters at one end at the same level as the other and then mounts up on a steep slope within the station so that on leaving, it is about ten feet higher up than the first track.

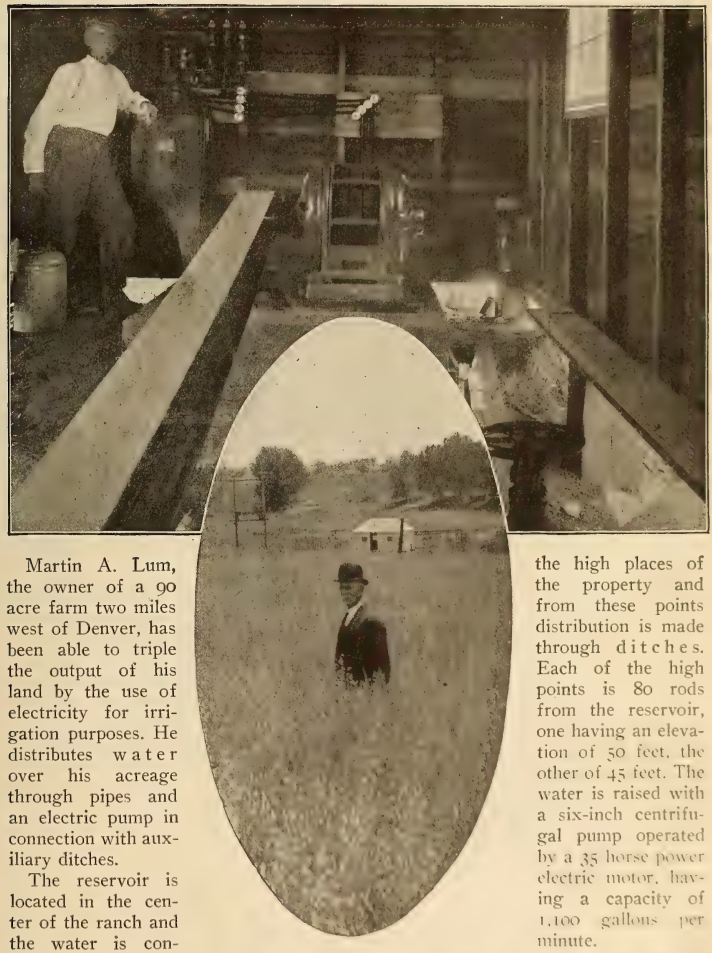


A SECTION OF THE PARIS SUBWAY AND ONE OF THE ODD STATIONS

Owing to the arrangement of the two lines, the engineers were led to give an unusual shape to the station and the part of the tunnel lying next it, as will be noticed. One of the views shows the tunnel with one track lying above the other after leaving the station. Together with the station itself, this part of the subway makes up a length of 280 feet. As the second view shows, the station is built up of three sections which increase in height so as to allow for the rise of the second track. Then come two short sections and after this each of the tracks continues on its way in its own tunnel. At the other end of the station, on the contrary, both tracks lie in a common tunnel of the usual somewhat elliptical section. This latter tunnel then runs down considerably and passes under the Seine, rising on the other bank and then proceeding on its course.

The present section of the subway belongs to the new line which connects the west end of town or the Auteuil district with the center of town at the Opéra.—*Abstract from La Nature by F. P. Mann.*

ELECTRICITY VERSUS GRAVITY SYSTEM FOR IRRIGATING



IRRIGATING PLANT FOR A 90-ACRE FARM AND THE RESULTS WHICH IT PRODUCES

Martin A. Lum, the owner of a 90 acre farm two miles west of Denver, has been able to triple the output of his land by the use of electricity for irrigation purposes. He distributes water over his acreage through pipes and an electric pump in connection with auxiliary ditches.

The reservoir is located in the center of the ranch and the water is conveyed through two ten-inch mains to the high places of the property and from these points distribution is made through ditches. Each of the high points is 80 rods from the reservoir, one having an elevation of 50 feet, the other of 45 feet. The water is raised with a six-inch centrifugal pump operated by a 35 horse power electric motor, having a capacity of 1,100 gallons per minute.

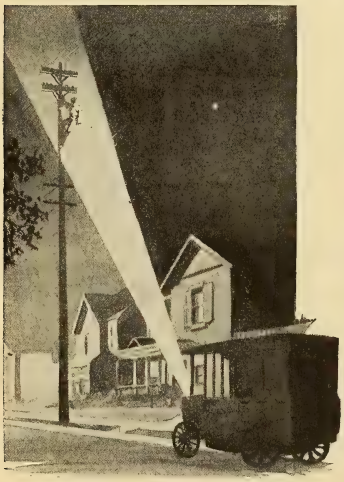
The plant was installed at an ex-

pense figuring $50 per acre and the cost of operation in a year amounts to $3 per acre. But the owner declares that the ranch has increased in value by $150 per acre.

It is pointed out that there are many advantages of electric pumpage over the ditch water. There is an absence of sediment and weed seed in the water and the water is warmer than from the ditch. The storage in the reservoir gives it a chance to attain a degree of warmth which the chilly mountain stream does not have. Current for the pumping is furnished by the Denver Gas and Electric Company.

Searchlight on Repair Wagon

A new wrinkle with the Dayton Lighting Company is to equip one of its electric repair wagons with a searchlight for



LINE REPAIRING BY SEARCHLIGHT

after-dark emergency work on its pole lines. The truck is run alongside and its beam, directed at the pole top, enables the lineman to make connections as conveniently as in daylight.

Largest Lightning Arrester in the World

IMMENSE LIGHTNING ARRESTER TO PROTECT HIGH VOLTAGE LINES

A lightning discharge takes place at a voltage far beyond measurement and exceeding any electrical pressure that man has thus far utilized. However, a slight approach towards lightning's high pressure is the operation of 110,000 volt transmission lines. To protect these lines gigantic lightning arresters are neces-

sary. In the illustration is shown one of the four tanks required to make one of the General Electric Company's 140,000 volt aluminum lightning arresters. A lightning discharge in striking a high voltage line would play havoc with the generating plant were it not quietly disposed of in the ground near the entrance to the plant by these carefully built and insulated protective devices.

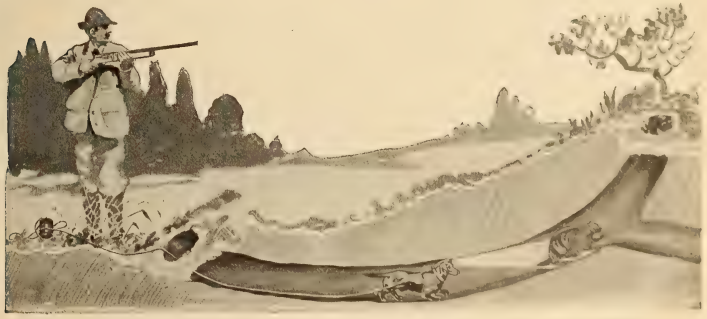
A New Cord Adjuster

A cord adjuster operating on the principle of the shade roller is shown with the small boy just about to complete the insertion of the drop cord. The grooved wooden roller is wound up against its spring far enough to have the necessary tension to take up the cord to the desired length. The light is raised and lowered in the same manner as a window shade, an upper and lower guide carrying the cord.

Frightening Badgers with a Searchlight

In some parts of Portugal a queer method is pursued in regard to the hunting of badgers and foxes. Badger hounds are used—short-legged animals that can crawl into the burrows of their quarry. Each dog is provided with a collar on which is mounted, like a tiny searchlight, a little electric light operated from a small battery which can be carried about by the hunter.

When the dog enters the hole the light is turned on, and the glare frightens the hunted animal out at some other hole, where he is bagged.



THE BADGER HOUND AT WORK WITH A SEARCHLIGHT TO SCARE THE GAME

The New Cambridge Subway to Boston

By LIVINGSTON WRIGHT

SUBWAY ENTRANCE NEAR HARVARD SQUARE

Cambridge and Boston's $20,000,000 outlay on street railway subways, power houses, tunnels and equipment is the latest effort to solve this mighty problem of transportation that is puzzling the cities of the world. In the just-completed "Cambridge subway," as goes the popular expression for the vast system of improvements being brought to the finishing touch by the cities and transportation interests of Boston and her sister municipality, there exists, if not absolutely the finest, certainly one of the most perfectly constructed pieces of municipal engineering in the world.

The stamp of "Boston" is all through the huge project, as unmistakably, uniquely and genuinely as if the word were cut into every bit of steel, concrete, copper and glass employed in construction. Carefully, calmly, conservatively solidly and for-all-time designed; built with exactness and such care that only five deaths resulted in the entire subway and tunnel work; finished and embellished in that peculiar Boston way of soberness and chasteness which at the same time result in a true elegance, this mighty undertaking may well be studied as the apotheosis in the latest method of scientifically alleviating city traffic troubles.

Properly to complete the original project of building a tunnel under

INTERIOR OF THE NEW BOSTON-CAMBRIDGE SUBWAY

Beacon Hill upon which the State House stands, on crossing the Charles river and making a subway thence, 2¼ miles to Harvard Square (near the University), in Cambridge, many incidental and monumental works had to be planned and constructed. The total cost of the work was $19,050,000.

The largest single piece of new construction is the tunnel and subway venture which costs $10,000,000. There are three sections in the Cambridge subway. The first is the subway proper 13,200 feet long, including the elevated track over Boston bridge (1,950 feet long), for which the Boston Elevated, the concern which operates the street railway system of Boston, Cambridge and other suburbs, paid Boston and Cambridge some $425,000 for the right to use. The second section (675 feet long), is the short piece of elevated structure which fills the gap between the end of the West Boston bridge in Boston and the Beacon Hill tunnel. The third section is 2,500 feet long. This makes a total of 3.1 miles.

The $3,500,000 power house expenditure represents the big new power station in South Boston and its seven substations where power is transformed for the use of cars. Six of these latter are now operating and for the last two months this power station has been generating power at the lowest cost of production in the history of the Boston Elevated. The two steam turbine generators develop together 40,000 horsepower.

The expenditure for equipment includes 40 Cambridge subway cars, 50 prepayment surface cars and 20 elevated cars. The Cambridge subway cars are a new idea. They are of steel entirely, seat 72 persons and cost $11,000 each.

THE ALL-STEEL SUBWAY CAR

Some idea of the the scope of details in construction may be gained from remembering that 2,500 men have been employed each day of the more than two years of subway building, and that for much of the time 4,000 men were at work! There was over 500,000 yards of excavating in Cambridge, and 4,000 tons of structural steel used; 6,000 tons of steel rods for concrete; 350,000 barrels of cement; 350,000 tons of crushed stone; 200,000 loads of sand.

The Cambridge subway extends just 2¼ miles from Harvard Square, along Massachusetts Avenue, past the entrance station at Central Square, and turns in southwesterly under Cambridgeport to arise to the surface at Kendall Square near the West Boston Bridge. A graceful, concrete-arched elevated structure takes the trains across this bridge at the Boston end at Charles and Cambridge streets. The elevated structure carries them on to the mouth of Beacon Hill tunnel at Grove Street, a comparatively short distance. From thence through the tunnel to Park Street Station (near the famous Park Street church) is but a swift, short shoot.

The Modern Sculptor

The great Shield of New York State, destined to occupy the place of honor above the doorway of the new Immigrant's Savings Bank in the Metropolis of America, is being sculptured in marble by the six sons of Joseph Piccirilli, a sculptor of Rome. These six boys, Horace, Thomas, Furio, Attilio, Furuccio and Getulio, came to New York in 1887 to carve out fame and fortune for themselves in the art of their father.

Fame has come to them, as they are known as among the leading sculptors of America. Unlike their father, who chiseled away in the slow and tedious process of the old school, these six sons caught the American spirit of the times and have substituted electricity for hand power wherever practicable, without sacrificing one whit of art and all that it signifies.

The first thing to be done to a block of marble is the roughing-out, at best a laborious and lengthy task when done by hand. Modern drills operated by compressed air, produced by electricity, chisel out the superfluous corners and the portions of the marble that will not enter into the making of the statue. These drills drive a row of small holes several inches deep, where the split is desired; wedges are then inserted and driven in by hand, until the piece drops off. The work of roughing-out is expedited seven-fold by the use of the rapidly pulsating drills.

Electricity and compressed air also supply the means of finishing the work on a piece of marble. This process consists of reducing the surface of the statue from a chiseled-out state to a smooth one, ready to receive the polish. The electric finishing tool gives a great variety of finishes not to be obtained by

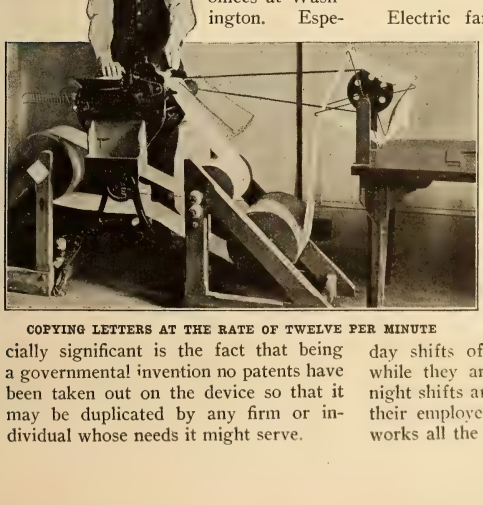
SCULPTURING BY ELECTRICALLY DRIVEN TOOLS

hand work, and does in one day the work of a whole week.

The Piccirilli Brothers' plant consists of two tanks of compressed air, in one of which a pressure of 100 pounds is maintained. This is used for the roughing-out work and gives 200 pulsations to the minute in the drills. The air in the other tank is kept under 25 pounds pressure and gives the finishing chisel 90 beats to the minute. A 35-horsepower motor supplies the power.

Electric Dryer for Letter Press Copies

In almost all business houses where press copies are made of the outgoing typewritten letters more or less trouble is encountered in drying the copies rapidly. To solve just this difficulty an ingenious and comparatively inexpensive electric dryer has lately been perfected by one of Uncle Sam's experts and has been introduced most successfully in several of the most up-to-date government offices at Washington. Especially significant is the fact that being a governmental invention no patents have been taken out on the device so that it may be duplicated by any firm or individual whose needs it might serve.



COPYING LETTERS AT THE RATE OF TWELVE PER MINUTE

The new electric dryer may be used in connection with any of the standard models of rapid roller copiers now on the market and it virtually requires no extra power—the whole operation of the dryer being dependent upon the "pull" of the copy paper as it unwinds from the roll and passes between the various rollers. Essentially the dryer consists merely of three rollers, cylinders or drums hung in a wooden frame.

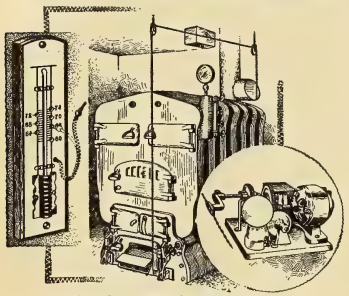
All the drums have wooden ends (perforated for ventilation), but the circular face is formed from a good grade of galvanized iron. Inside each revolving cylinder are three 32 candlepower incandescent lamps which furnish the heating power. At the outset Mr. W. Musser, the Federal expert who invented this dryer, installed electric heaters in the cylinders, but it was found that the heat could not be regulated so minutely as by means of the ordinary lamps. Under operating conditions the current is turned on fifteen or 20 minutes before it is desired to begin the drying of copies and the heat is never sufficient to scorch the paper.

Electric Fans in India

Electric fans seem to be replacing some coolie labor in India where, at certain seasons of the year, it becomes necessary to employ some means of fanning and keeping mosquitoes away. The regular price for four coolies to divide up the 24 hours between them is six cents each per day. With electric fans the cost is reduced, and considerable inconvenience is avoided as well. The day shifts of coolies do reliable work while they are being watched, but the night shifts are likely to quit work while their employer sleeps. The electric fan works all the time.

Automatic Temperature Regulator

The addition of an automatic control to a heating system takes away much of the care of operating it when the control system is simple. The Utility electric thermostat, with a motor in connection,



AUTOMATIC TEMPERATURE REGULATOR

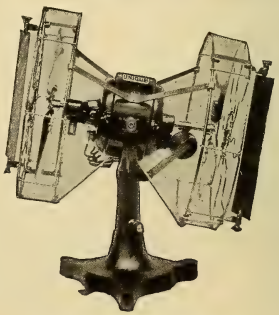
does this work. The thermostat is a thermometer. The expansion or contraction of the mercury column of the thermometer brings it into contact with platinum wires woven at intervals into the glass tube, and completes an electrical circuit. The current then passes along the wires to the motor box in the basement, starts the mechanism therein, and by a simple turn of a shaft controls the furnace or boiler drafts and dampers.

Suppose it is desired to maintain a temperature of 66 degrees. The small plug is inserted in the socket corresponding to the 66 degree point on the thermometer. While the mercury is below the wire connected to the plug, the mechanism will keep the front draft open and the rear check damper shut. This causes the fire to burn briskly. But, as soon as the temperature of the room rises so that the mercury touches the contact point (66 degrees) opposite the plug, an electrical circuit is completed which in turn, through a simple relay, controls the current to a small motor operated from the lighting circuit. Current flows through the wires to the motor, causing it to move the elbow shaft in the opposite direction to which it had been moved. This immediately reverses the position of the draft and damper and instantly checks the fire. Should the temperature fall as much as 1-10 degree below the point at which the contact plug is set, the motor operates long enough to again open the draft and close the damper.

The electric thermostat can be installed in any house wired for electric light. The thermostatic thermometer is placed in the living room, or any central room in the house from which it is decided to govern the house temperature. The wires run through the wall down to the basement and there connect with the motor box. This box, which contains the operating mechanism, is attached to the ceiling over furnace or boiler or to any convenient place nearby. A projecting shaft with elbow attachment operates the draft door and check damper by a simple chain arrangement.

A New Type of Fan

An electric fan with such special features that the manufacturers have named it "Unique" is here illustrated. The fan has two sets of blades and revolves in

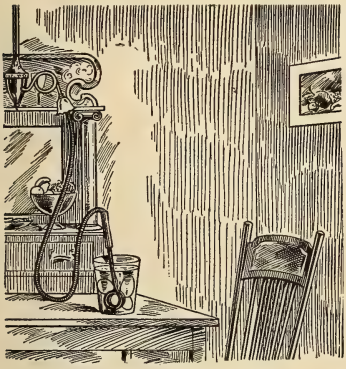


FAN WITH TWO SETS OF BLADES

a circle. While running, it also tilts or see-saws. Three running speeds are provided for and by adjusting a set screw the amount of the tilt is regulated.

Boiling Water in a Hurry

While the breakfast toast and coffee are being made, the eggs may at the same time be boiled by turning the

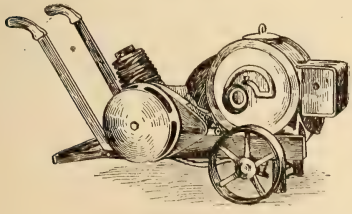


THE UTILITY WATER HEATER

switch to which a little electric heater is connected. This device, called the Utility heater, is small enough to plunge into an ordinary water glass. The heated portion is entirely under the water when used, so that no heat is lost and the device can be used on either direct or alternating current.

European Farm Motor

The cost of installing and maintaining a number of small motors, each of which is used only occasionally, is often considered as an argument against the use of electricity on the farm. This

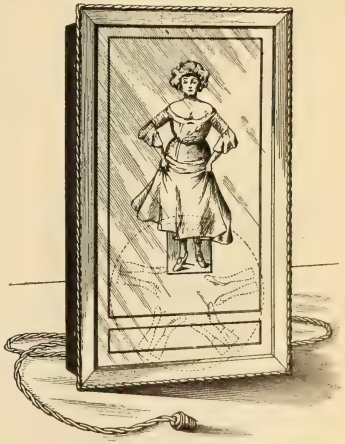


FARM MOTOR

objection, however, disappears if a single portable motor is used. A Swiss firm is placing upon the market a portable motor built in sizes from two to six horsepower. The weight of the motor is so well distributed that in handling, only 49 pounds fall upon the handles. The uses to which the equipment has already been applied are threshing machines, wine presses, wood saws, corn shellers, feed cutters, etc.

Shoe and Hosiery Display Device

A clever advertising device for displaying successively upon the same figure several styles of shoes and hosiery



SHOE AND HOSIERY DISPLAY

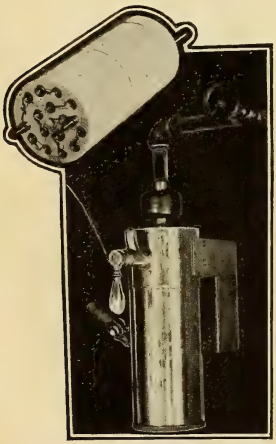
is the invention of G. T. Fielding, Jr., of New York City. Within a suitably framed casing is arranged a female figure. Upon a circular revolving display board are placed the articles to be exhibited. The revolving board is entirely hidden except for an opening in the proper position to make the goods appear as if upon the figure. When the outfit is connected to an electric circuit

the motor driven mechanism causes the arms to drop the skirt for a moment, during which time the display board revolves, bringing a new pair of shoes or hose to the opening. The board stops for an instant and the arms of the figure lift the skirt. In a few seconds the operation is repeated with the next articles upon the board.

New Type Instantaneous Water Heater

This is an instantaneous water heater consisting of bare resistance wire coils within a series of passages in a porcelain cylindrical body through which the water flows when the faucet handle is turned.

The faucet handle is arranged to operate a special snap switch turning the current on and off with the water. The heater may be connected to either direct or alternating current, and where

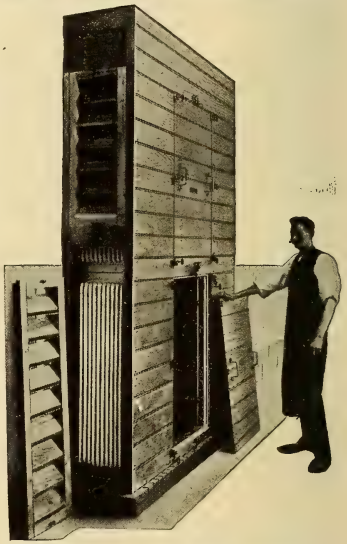


INSTANTANEOUS WATER HEATER

attached to the water pipe it is provided with an insulating joint. This is to eliminate the leakage of current except through the water, which as shown in the open porcelain cylinder comes in actual contact with the electrically heated wires.

Filtering Air for Dynamos

In modern German power stations where turbo electric generators are used it is now quite commonly the practice to filter the air which circulates through



AIR FILTER WITH DUST PROOF WOODEN CASE

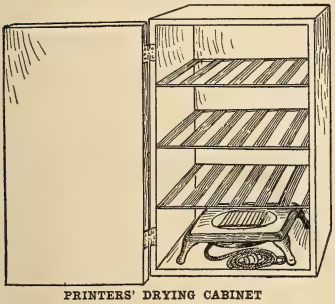
the generator or dynamo coils and about the collecting rings. All dust and flying particles are taken out, which might eventually be harmful to the insulation of the machine.

There are various types of filters, one of which is shown in the picture. Pockets are provided inside the case, lined with cloth, and through this cloth all the air must pass on its way to the pipes leading to the dynamo.

In some cases the cabinet or case containing the filtering screens is built permanently into the wall. In others it is made portable so as to be moved easily to any convenient wall opening.

Paper Drier for the Job Printer

A Kentucky printer has found that a 770 watt electric heater is one of the biggest money savers in his shop. He has constructed a drying cabinet, with the heater in the lower compartment, while above it, on light wooden frames, the sheets to be dried are placed. Work which would require lying undisturbed

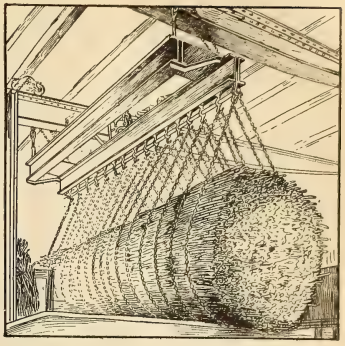


PRINTERS' DRYING CABINET

24 hours at the ordinary temperature of the room will dry in the cabinet in less than an hour, and can then be printed on the reverse side or handled without any danger of "offsetting" or smearing. As so many printing jobs are rush orders, an electric drying cabinet would be a valuable addition to any printing office, for it will clip off many hours in time.

Handling Cane in Sugar Mills

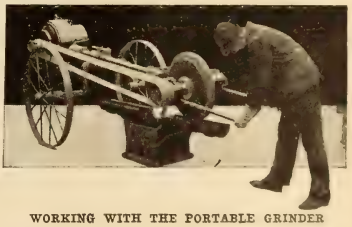
The sugar mills of the West Indies yield rich returns on investments, so that it is not difficult to understand why millions of dollars are invested there in mills and lands. But to bring these returns, well handled mills and a steady supply of cane are necessary. To both of these needs electrical equipment contributes. The cane cut in the fields by natives is loaded upon ox-drawn wagons and hauled to the nearest railroad. Cars are stacked with the cane, which is then forwarded to the mill, where it is unloaded in a small fraction of the time required to load it. An electrically operated hoisting crane especially fitted with numerous chains and hooks lifts the entire mass at one time and dumps it into the crusher, where it is cut into small pieces and starts upon its journey by passing immediately through the first set of rolls.



ELECTRIC CRANE HANDLING SUGAR CANE

Trimming Off the Rough Spots

Another one of the former hand operations in large shops is doomed. When castings were too heavy to be held up against an emery wheel it used to be customary to chip off the rough projections by hand. Now the up-to-date workman comes along with his motor driven grinder mounted on a little cart, so that he can touch up the castings in a very few minutes and without either moving the castings or greatly exerting himself.



WORKING WITH THE PORTABLE GRINDER

Electrical Men of the Times

MATTHEW C. BRUSH

Matthew C. Brush, one of the most noted street railway and traction executives in the East, has just been appointed second vice president of the Boston Elevated Railway, with special duties to be assigned by the executive committee and by the president.

The rise of Matthew Brush in the street railway world has been rapid but fully merited by his talents. He is only 37 years old, but has had a thorough practical experience from the ground up. He was born in Stillwater, Minn., and graduated from Armour Institute in 1897. He graduated from the Massachusetts Institute of Technology in 1901. He paid for his higher education in these technical institutions by his own work and enterprise, pegging steadily away until he won his degrees. When he launched into the whirl and competition of the railway business this steadfastness of purpose became the foundation of his later successes.

Finely equipped technically, he has the added gifts of practicability and executive ability, combined with tact and a genuineness that makes every one coming in contact with him feel that he is a friend. It is said of him that he could do more business in an hour offhand, with less fuss and feathers, than the average corporation official could transact in a day. On one occasion, while playing pool at a clubhouse, a salesman intruded upon his leisure to show him a sample of bellcord. Mr. Brush examined it carefully, told the salesman that if goods delivered came up to the sample they would be accepted, gave him a substantial order and resumed his pool playing. Many another official would have refused to talk business and have forced the salesman to come around to the company's offices next day and cool his heels in the anteroom for two or three hours, thus to be duly impressed with that official's importance, regardless of the fact that the salesman had other customers equally important with whom he had appointments.

After leaving Massachusetts Institute he entered the machine shops of the Union Pacific at Omaha as an apprentice, where he served his time. He then went to Council Bluffs as a machinist, and from there went back to Chicago, where he took a position with the Chicago, Burlington & Quincy road. He had already served as a rodman in Kansas for the Chicago & Rock Island.

In 1904 he joined the staff of the Boston & Suburban Electric Companies, as assistant to the president. At that time the properties consisted of nine street railways, a gas company and two amusement parks. In eight months he was elected general manager of the properties. In 1905 he was made vice president and general manager and a year

later was also made head of the Suburban Manufacturing Company, which was formed to build a $300,000 power house in Waltham.

Through his efforts the Boston & Suburban lines, which had previously been losing a great deal of money, were put upon a sound financial basis. His administration was marked by a co-operative policy between officials and employes, and when he resigned in 1909, 500 officials and employes of the company gathered in the theater of Morumbega Park to express their regard for him.

He left the Boston & Suburban to become general manager of the Buffalo & Lake Erie Traction Company, the Jamestown, Chautauqua & Lake Erie Railroad and the Jamestown & Chautauqua Steamship Company, operating 200 miles of electric lines, 50 miles of steam road and a fleet of steamboats on Lake Chautauqua. He remained in this position a year, when he was called back to Boston to become assistant to the vice president of the Boston Elevated Railway, which controls the largest traction system under one unit in the world. For the past year he has been chairman of the efficiency committee, which acts as an advisory and assistant committee to the president, executive committee and the vice president.

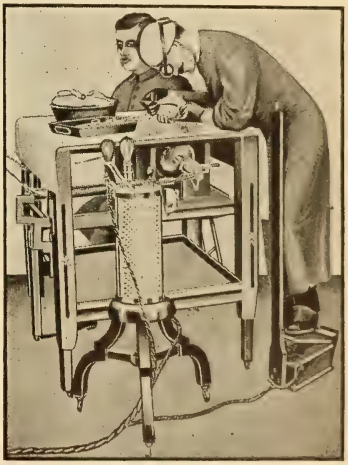
Mr. Brush is a member of the Newton Club, the Pales Club, the Waltham Business Men's Club, Delta Kappa Epsilon, New England Street Railway Club, the Boston City and University Clubs and is an associate member of the American Street & Interurban Railway Association.

Speaking of the Boston traction service at a meeting in Wells Memorial Hall held recently to discuss the subject, "How Can Overcrowding in Street Cars Be Avoided?" Mr. Brush said he believed that the solution was in overcoming the physical peculiarities of Boston by new facilities and by using the new large prepayment, semi-convertible cars, of which 100 are now in use and more ordered. Eventually the entire system will be using them. The company now has 28 miles of cars, and extra cars are impossible in the congested section of the city, which contains only five miles of outward bound tracks, against over 700 miles on the entire system.

Adapting the X-ray to Minor Surgery

The assistance rendered the physician by the X-ray in the examination of broken bones and in the setting of these has given impetus to the designing of apparatus for this service.

The accompanying illustration shows a piece of apparatus devised by Dr. Grashey of Germany to use in operations



USING THE X-RAY IN SURGERY

in which the bone structure or material worked upon is small. A needle buried in the flesh of the hand is being removed. The surgeon wears a special eye piece which shields the eyes from daylight, the work being performed in the daytime. A foot switch serves to turn the current on and off the tube which is supported on the underside of the table.

Electrical Interests of Women

EDITED BY GRACE T. HADLEY

Electricity in the Summer Home

"We are fitting up a summer home on the North Shore," chatted Mrs. Arthur Dainty, over a cup of tea at the home of a very dear friend. She was an Easter bride and bubbled with enthusiasm and the mere joy of living. Her best friend and adviser was Mrs. Eleanor Beach, a famous club woman, with whom she frequently spent an afternoon. Mrs. Beach beamed upon her petite and pretty visitor with a kindly smile of approval. She approved most heartily of bubbling brides, blithe joyousness and home happiness.

"That's good news," she remarked in her even, musical voice. She had a well trained voice and could address a fashionable club with fervor and brilliance.

"You know I have had such charming chats with you over this electric samovar," bubbled little Mrs. Dainty, "that it gave me an idea. I have been studying things electrical and I am fitting up our home with the new power appliances and if I am left without a servant I shall not be entirely helpless.

"All the domestic power appliances today are a long step toward the solution of the servant problem," remarked Mrs. Beach.

"Of course I shall use electricity as an illuminant," Mrs. Dainty ran on with enthusiasm, "and I shall have a chafing dish and a toaster. But best of all, my husband has promised me an automatic electric cook stove, a power table and we are to have an auto-electric refrigerating plant on our ice-box."

"Wonderful!" exclaimed Mrs. Beach. "Housekeeping today is not the awful drudgery it used to be, and the furnishing of a home is not the task it once was, especially the fitting up of a summer home."

"Oh, yes," pursued the little bride, "with the modern reed craft furniture, wicker craft chairs, comfort rockers and electric wicker lamps, one can manage to make a summer home quite comfortable."

"Then there is the rattan furniture for porches and dens," she continued, "and the Chinese grass chairs imported from Hongkong. They are simply ideal for lawns on account of their resistance to moisture."

"Speaking of Hongkong," interrupted Mrs. Beach, "reminds me of the exquisite suggestions for artistic summer homes that come to us from the far east, from Japan, for example. We do not see nature as the Oriental sees it and as his art proves that he sees it. The Japanese artist with a few dashes of the brush, seizes and reproduces with an incomprehensible power of interpretation, not the recollection of any individual blossom, but the perfect realization of the general law of form. The Japanese artist gives you that which he

EXQUISITE SUGGESTIONS COME FROM JAPAN

with tapestry backs. The electric lamps must be encased within those unique and delicate silken shades decorated so wonderfully by Japanese art, and of course there should be screens."

"And dragons?" inquired Mrs. Dainty with breathless interest.

"Yes," laughed Mrs. Beach, "and some lacquer ware, a statuette of ivory, a few pieces of that lovely porcelain, and an incense vase of bronze. How would that do?"

"I am delighted with your suggestions. I think they are quite perfect. I was wondering just how I would fit up the suite in the west wing, but you have solved the problem for me. My general living room is somewhat Colonial in style with a fireplace for chilly mornings and cool evenings. Above the mantel are paneled decora-

A GENERAL LIVING ROOM SOMEWHAT COLONIAL IN STYLE

feels, the precise sensation of an hour or the mood of a season. He steeps his distances in mist or bands his landscapes with clouds and stimulates the imagination."

"And the western artist?" queried Mrs. Dainty.

"Too often renders minute detail and satisfies the imagination."

"The Japanese decorative designs are exquisite. I love them and I believe I shall have a Japanese suite in my summer home. Would not that be delightful?"

"Indeed it would be," responded Mrs. Beach with enthusiasm.

"Then help me plan it, this very minute."

"First there must be the finest matting for the floors and a Japanese rug over that and the furniture of polished wood

tions in color, suggestive of summer blooms. Huge beams of oak project outward and bear the lighting fixtures, which are imitations of the Colonial candle, and there is a lantern effect on the lower side of the beam. The wood trim is ivory white paneled with Japanese grass cloth. There will be plenty of fumed reed furniture with brown leather cushions, built-in book cases and similar accessories, while the window fabrics are in two tones, a delicate green combined with golden brown."

"I think your summer home will be a most enjoyable place and I shall give myself the pleasure of visiting you often," laughed Mrs. Beach. In fact, I am almost persuaded to abandon my northern trip and camp in that Japanese suite we have just planned."

"Nothing would please me better," cried the little bride, giving her friend a joyous hug. "You know we thought of going abroad on our wedding trip and then we said: 'Oh no, let us spend our money here and make a home that shall be the perfection of comfort and convenience.'"

Home Refrigerating and Ice-making Plant

"Just what I have been looking for!" This is the expression of every up-to-date housekeeper who sees the auto-electric refrigerating plant, another silent, automatic servant for the modern home and a safe, sure, labor saving device. There is no uncertainty about the ice supply during a continued hot spell in the summer time. Many a housekeeper has had the following experience in the middle of a hot afternoon on a very hot day. The perspiring maid trails up the stairs and announces that the ice is nearly gone. Company is expected to tea and worse still it is a holiday!

"But I told you to order an extra supply to last over the Fourth," protests the perplexed hostess.

"I did, ma'am," replied the maid, "and the ice man said he couldn't because he was running short on all his orders, and I had to wipe up after him because he always comes in just after I clean the floor. It makes no difference when I clean that floor, the ice man comes in afterwards, and makes tracks," continues the maid in an injured tone.

"Well, send the yard man out and tell him to buy some ice somewhere," interrupts the mistress, "we're expecting a guest to tea and we must have ice."

"Please, ma'am, the yard man has gone for the day——" the maid begins again. Every housewife knows the story. It is just the day when the last straw breaks the camel's back, and the housekeeper is convinced of a conspiracy on the part of

NO UNCERTAINTY ABOUT THE ICE SUPPLY WITH ONE OF THESE MODERN REFRIGERATORS IN THE KITCHEN

the weather, the ice man, the maid and the invited guest, to make her life as miserable as possible. Not so with an electric refrigerating plant in the home. You can have the ice when it is most needed. Best of all, you can have the

nicest little cubes of ice made to order in your own ice box, ready for the ice tea or for a glass of lemonade.

A small motor driving a compressor with a system of piping and a storage tank inside the ice box are the essential elements of the refrigerating plant. Down in the lower part of the refrigerator is a marvelous instrument, the thermostat, which regulates the temperature and maintains an even 45 degrees or so, never varying over two degrees. The contents of the ammonia tank may be replaced twice a year at a cost of one dollar. When the required temperature is reached, the motor stops. Should the ice box be opened so that the temperature rises, the motor, in obedience to signals from the thermostat, starts automatically and the temperature is reduced.

Telephone Etiquette

A newspaper in Michigan is authority for the statement that four hours and fifteen minutes were consumed by a couple of estimable ladies in a telephone chat one Sunday afternoon in a town of that state. Needless to say this town has flat rates. But think of it! Count up the time consumed, four times 60 minutes plus fifteen more. It is said that the connection was put up soon after noon and from that time until after dark there was continuous talk. No one could get in on the line. Everybody else was talked off the wire. No transcript of the conversation has been preserved but it probably ran along like this:

"Say, Mrs. X, I want to ask you about that pattern you promised me. You said you had loaned it to Lydia Smyth but that I could have it as soon as she returned it. Did you ever get it back?"

"No? Well, wasn't that careless of Lydia? Did you notice her dress at church this morning? Didn't it hang simply awful? And that is the one she made herself! Well, if I couldn't sew any better than that I wouldn't borrow other person's patterns and then neglect to return them.

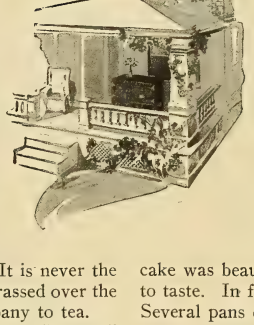
"Have I heard about the Brown's baby? No, what is it? Measles! And I better not let Tommy go over there! Indeed I won't, but I saw the other Brown children at Sunday school today and I don't think they should be allowed to run at large. Oh, you're not sure it's the measles, you merely heard that some

PERHAPS A YOUNG GIRL AND HER SWEETHEART MONOPOLIZE THE PHONE

one else thought it might be the measles!"

Imagine 255 minutes of such conversation and other people waiting to use the line. A record breaking conversation of this length shows an utter lack of consideration for the rights and necessities of other people, and yet many of us, who are on party lines, recall that we have waited while similar estimable ladies or perhaps a young girl and her sweetheart monopolized the phone beyond the limits of patience. The telephone is one of the greatest modern conveniences. It has placed all mankind within earshot of each other but it should be used in a businesslike manner even by women in their homes.

The Silent Servant



It was Saturday afternoon and baking day at the home of Mrs. B. T. McCanna, 6320 Ingleside avenue, in Chicago. Two visitors trudged up the steps and rang the bell, but Mrs. McCanna did not mind a bit because visitors called on baking day; neither did the Silent Servant. Now right here is the first great advantage of this remarkable new servant. It is never the least bit flustered or embarrassed over the advent of visitors or company to tea.

"We came to see the Silent Servant," was our explanation, and Mrs. McCanna laughingly led the way to the kitchen.

"Well, here it is," she said. "Inspect it as much as you like. It doesn't mind at all."

A modern automatic electric cook stove, made of solid oak, stood in a corner of the kitchen. It was 35 inches high with top and doors of finished asbestos and nickel trimmings.

"Now, let's see what it will do," we demanded with interest.

"Well, I'm going to stir up a sunshine cake first and here is the recipe I use: Whites of seven eggs, yolks of five; 1¼ cups granulated sugar, one cup flour, scant third teaspoon cream tartar, a pinch of salt added to the whites of the eggs before whipping, and flavor to taste. Sift, measure and set aside flour and sugar. Separate the eggs, putting the whites in a mixing bowl and the yolks in a small bowl; beat yolks to a very stiff froth. Whip whites to foam, add cream tartar and whip until very stiff; add sugar and beat in (always using a spoon to mix cakes with), then flavor and beat in; then flour and fold it lightly through.

This cake was put into a cold oven at 2:40 by the clock. The thermostat was set at 250 degrees and the electric current was then turned on. When the oven reached the degree of heat indicated by the thermostat, there was a sudden click and the current was automatically cut off and the baking was done with the heat stored in the oven chamber. The cake was beautifully baked and delicious to taste. In fact, it melted in the mouth. Several pans of biscuit were then put in at 300 degrees of heat and were baked in the same way. Four apple pies went into the oven at half past four o'clock. Pies require 350 degrees, and when taken out they were so well baked they shook loose from the pans.

Rice was cooked in the boiling compartment. Mrs. McCanna used one cup of ordinary rice. This was washed thoroughly and put into an aluminum utensil, not a double boiler. Three cups of water and two of milk were poured over the rice. The thermostat was set at 212 degrees or boiling point. The current was on 20 minutes, then was automatically cut off and the rice cooked on the receding heat principle.

"I often set rice or oatmeal to boil this way," said Mrs. McCanna, "for the boys' luncheon, and I go down town. In a third of an hour the current is cut off, but the cereal continues to cook until the boys come home at noon. Then they take the nice warm food out of the oven and make their lunch on it together with bread, milk and jam."

"This is certainly an easy way to cook," remarked one of the visitors.

"Oh, I wouldn't go back to a gas range for anything," said Mrs. McCanna with

emphasis. "I cannot imagine a greater hardship. Now I will stir up some cup cakes." After the cup cakes were taken out of the oven, a pan of apples went in. Last of all four loaves of bread in an aluminum bread pan were put in and the thermostat was set for 350 degrees. The bread went into the oven at 5:20 o'clock and baked for 50 minutes, during which time the current was on for 30 minutes, and the balance of the time the bread baked in receding heat.

"Do you wonder I like to bake?" asked Mrs. McCanna, with pride, as she took out of the oven chamber four of the most beautiful loaves the visitors had ever looked upon. "The only drawback to the new stove is this: the family eats more than it ever did before, because the things taste better and are so well cooked. I bake three times a week and four loaves each time, besides the pies, biscuit and cup cakes of which every member of the family is so fond."

THE THERMOSTAT DIAL

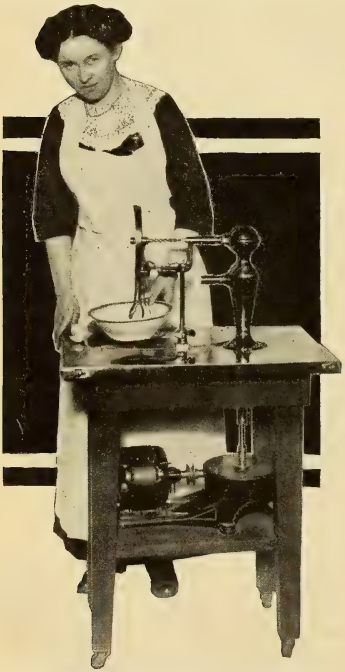
This Twentieth Century stove, twin companion in science to the wireless telegraph, the aeroplane and the automobile, has come to stay and its use will broaden the activities of the home and lighten the burdens of womankind. The last and final step in the development of this modern method of cooking is the application of the automatic control feature, an improvement that has eliminated one-half of the labor and drudgery of cooking. Imagine an automatic, silent servant that will get up at any hour that you may predetermine—four, five or six o'clock in the morning—start the cereal, heat the water, cook the coffee in the percolator and prepare everything correctly and keep it in perfect condition, until such time as you are prepared to eat.

The stove is really a marvelous appliance to free the housewife from the heart-breaking, shriveling heat of the kitchen and preserve her disposition and appetite to grace the daily meal.

A MODERN AUTOMATIC COOKSTOVE MADE OF SOLID OAK

The Household Portable Power Table

The Federal household power table is not only a source of power for household machinery but is a veritable little work shop in itself. This compact oak table, standing 30 inches high, can be moved as easily as a chair to any point where it is most convenient for operation. Mounted on a lower shelf is a ¼ horsepower electric motor which transmits power directly to an upright shaft or power arm, from which two horizontal shafts with protected couplings give available power at the top of the table. Electricity is supplied through a ten foot connecting cord securely fastened to the table and fitted with a detachable connecting plug for connection with the nearest lamp socket. The current is turned on or off by a snap switch conveniently placed on the right hand side of the front of the table.



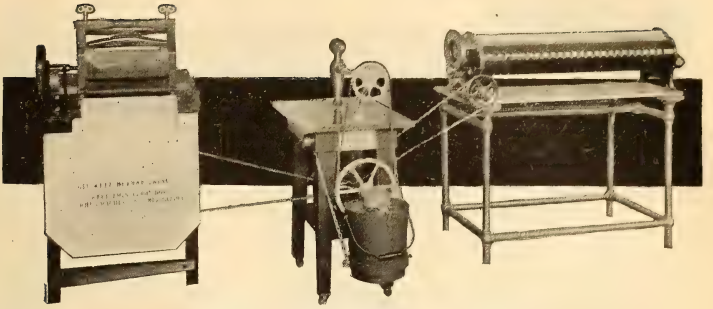
THE POWER TABLE WILL PERFORM PRACTICALLY ALL THE OPERATIONS IN PREPARING FOOD

In the kitchen, the power table will perform practically all the operations necessary in the preparation of food formerly done by hand. The nickel plated utensils, table top and all are easily kept clean and shining. It is hardly necessary to touch the food with the hands. Think what this means, not only from a sanitary viewpoint, but in the time saved in washing the hands the number of times necessary in handling and mixing the materials for cooking.

In the laundry the power table can be used to run the washing machine, wringer or the mangle and still have one hand free to turn the ice cream freezer, run the knife sharpener, or shave the soap for washing at the same time. The attachments for the power table are a bread mixer, cake mixer, coffee grinder, food chopper, ice cream freezer, egg beater, vegetable slicer, food grater, apple peeler, knife sharpener and knife polisher.

Tools for Housekeeping

In a current magazine, Elizabeth Atwood writes: "It is strange how many very good housekeepers are careless about the tools of their routine work, both in regard to the completeness of the equipment and in the care of them. It is the old story, almost anything will do, as long as it holds together, and is allowed to serve in the average kitchen or in connection with the care of the house. This, however, is far from being true

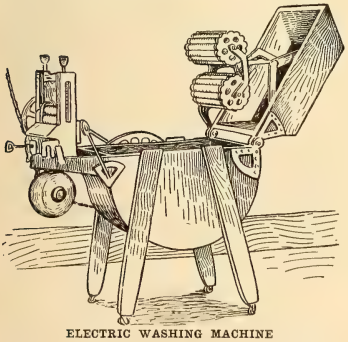


THE POWER TABLE AT WORK IN THE LAUNDRY

economy. The simplest furnishings, the really needful, should be of the best, and it goes without saying they should be kept in perfect order."

Washing Machine with the Washboard Principle

An electric washer that utilizes the principle of the washboard but does away with hand rubbing is a feature of a new washing machine called the "New-disco." It will wash few or many clothes, is very light running and the cost of operation is low. Raising the lid throws the washer out of gear. No clumsy lever is necessary to do this, neither is it necessary to stop the motor while the machine is running. The clothes can be inspected or more water added while the machine is running. It has a reversible wringer and the washer and wringer can be run at the same time, enabling clothes to be run through from the rinsing water while another lot is being washed.



ELECTRIC WASHING MACHINE

Electric Cooking Utensils

The individual articles manufactured for electric cooking certainly cost more than ordinary cooking utensils, but there is no necessity for having so many of them. With a little forethought it is surprising how many of the usual cooking pots and pans can be discarded. Once the electric outfit is purchased, it will need renewal only a third as often as the others, owing to its careful manufacture and good material.

In addition to this one of the special features of cooking by electricity is the uniformity of temperature that can be maintained. The heat is not greater in the oven one day than on another, and so with each of the electric cooking appliances.

Electric plate warmers are convenient and inexpensive to operate and are very useful in the pantry. When dinner is delayed for any cause, plates and food can be kept warm while waiting.

Junior Section

Thorne Elliot's Burglar Alarm

By CLARK DeBALL

The first time I ever saw Thorne Elliot he was preparing to drop a model Bleriot monoplane from the window of what he called his laboratory.

"I knew it," said I looking up at him from the back yard.

"You knew what?" he asked.

"Knew you was about fourteen and had red hair and freckles. We moved into the flat under yours five days ago and we're only just beginning to get used to the racket you make. Nobody but a red-haired guy could make such—"

"Yea," he interrupted, "I've been making an airship."

"Who plays all that rag on the piano?" I asked.

"Oh, that there's only my big sister. I'm an inventor," he said. "Come up to my laboratory and I'll show you some of my inventions."

I went up there. It was a room partitioned off on the back porch of the second flat. On the door was a sign, "Thorne Elliot, Inventor and Electrician —Crimes also ferited. Offise Hours After School."

Inside, a person could hardly move, there was so much electrical junk, wires, clock works and things. A white tom cat minus one ear lay blinking on a red cushion on the work bench.

"That's my cat," said Thorne. "His name's Old Scratch. He's grieving for his lost Lenore."

THORNE ELLIOT—INVENTOR AND ELECTRICIAN

"He looks it," I said.

"And here's my new burglar alarm."

"Why that looks like one of those little short-horned phonographs."

"Sure," explained Thorne. "That's what it is. It runs by a dry battery. You put it by your bed. These here wires go to the windows. When Mr. Burglar opens the window, he closes the circuit and—"

"I got you," I broke in. "The phonograph gives the alarm."

"Alarm!" exclaimed Thorne. "She gives a regular battle cry of freedom."

"Let's hear it once," I suggested.

Thorne carefully closed the door.

"Us inventors 've got to be careful," he explained. "I ain't applied for any patent yet. Besides I don't want the folks or any of the neighbors to hear it till I know whether it's going to be a success or not."

Then he started the machine.

Well, I've heard some pretty bum noises, but believe me I never heard anything like the heart-rending screech that came out of that phonograph. That old tom cat tore around and yowled so we had to let him out. After this screech came gurgling groans. Then in ghastly accents the words "Burglars! Burglars! Arise before ye are slaugh-

tered in thy bed! Thy throat will be gashed from ear to ear!" After this came more of those bubbly groans mixed in with wails. Then in graveyard tones the words: "Blood! Blood! Seven buckets of blood! Gore!" It ended with more yells. It was fierce.

Then the machine started to play it all over again.

"Stop that thing," I cried. "How long will it keep playing like that?"

"As long as the window stays up and keeps the circuit closed," said Thorne. "You see," he went on, "when that needle gets to the end of the record that disk hits that little lever and she reverses.

"Tonight'll be a fine time to try it out. Ma's going to spend the night over at Aunt Sadie's and Pa, he's out of town. I'm gona try it on my big sister Maude. I'll hide it under her bed."

"Gee! Won't she know it's there? Say, she'll be scared into fits."

"Not her," said Thorne. "She's got an automatic pistol. I loaded it for her, only I put in blanks so she can't do any damage. Anyhow, if she is startled a little, it'll be good for her. It'll teach her to be on her guard. About two a. m. I'm gona get up and sneak out and burglarize the flat. See? I'll get in the back window. It'll be just like the real thing."

"Say, let me in on that. Will you?"

"Sure," agreed Thorne.

So that night I didn't go to bed when the rest of the family did. I sat up and read "The Fall of the House of Usher."

About two o'clock Thorne scratched on the door. I went out into the hall. He had a black mask on. In one hand he carried a big old army revolver, in the other he had an electric torch and a can opener.

"Ssh," he hissed. 'Tread softly, ole pard. Here; you take the dark lantern and the jimmy. I'll carry the barker. I'm Bill Sikes."

"This here is no jimmy," I whispered. "It's a can opener."

"Come on," replied Thorne.

Well, we treaded softly out doors and around the house. It was quite dark and rather chilly for a June night. I was a little sleepy. Thorne in the lead, we sneaked up the back stairs. Half way up Thorne stopped and grabbed hold of me. We listened. Sure as fate some one was up on the porch fooling with a window.

"Dang this thing!" we heard someone mutter.

In a minute we heard another voice say, "Too bad we haven't a jimmy." We could hear the fellow at the window breathe hard and grunt like he was straining at the window. Then the other one whispered: "Let me try a while, brother."

"Well, be careful," came the low reply. "We don't want to wake em up."

One of the men went over to the edge of the porch. We could see him against the sky. He seemed to have a checked cap on, but no mask. When he went back we crept down stairs. My heart was making an awful noise.

"Gimme that gun," I whispered, "and run for the cop."

Thorne nodded and was gone. It was no time for words. At first I thought I would go up there and capture them so I would have my picture in the papers as a hero. But after a while I decided to wait for Thorne and the cop.

Because while we had heard only two men speak, how was I to know there were not more up there who had not spoken? One against seven or eight you know is no cinch. Well, after a while the window suddenly went up.

"Aha!" ejaculated one of the men. I guess he must have started to crawl in, when a terrible shriek rang out. Then, "Burglars! Burglars! Arise before ye are slaughtered—"

It was the phonograph and it was awful. The two men up on the porch began stamping around or fighting or something. "Bang! Bang!" went Thomas' sister's automatic—eight times in all. One of the burglars came down

the stairs about four at a time. He fell at the bottom. Then the other came banging down on top of him. One of them seemed to be clawing at something white on his back. I had gone toward the back fence in order to head them off if they came that way. To intimidate them I began letting off the old army revolver. "Bang! Bang!" answered the automatic upstairs. It sounded like the Monitor and the Merrimac. The burglars jumped up and hiked around the corner of the house.

Windows were going up all over the neighborhood. Between other noises I could hear the phonograph. I heard someone screaming, "Gimme the Chicago Avenue Police Station quick." Thorne's sister yelled "Help! Help! Murder!" Some one must have turned in a fire alarm. Oh! it was a glorious mess.

I went around to the front of the house. There in the glow of the electric light was the cop holding two men by the coat collars. Sure enough one of the men had a checked cap on. The cop seemed to be bawling them out. Thorne was there with his mask still on. A lot of half-dressed neighbors were standing around. One fat fellow had a broom.

The man with the checked cap was shouting, "Leggo my collar. I tell you, officer, I'm no burglar. My name's John Elliot."

"That's my old man, I tell you!" yelled Thorne.

"And this is my friend Rev. W. L. Wharton," continued Thorne's father. "He's a preacher."

"What wus ye runnin fer, then?" bawled the cop.

"Listen," said Thorne's father. "We came in unexpectedly on a late train. He was to stay all night with me. I had no key. We were trying to get in the back window so as not to wake up the house."

The preacher broke in, "Brother Murphy put up the back window and must have frightened some member of the family into fits. Some one is in agony up in that flat."

"Look at my face!" cried Thorne's father. "Some furry wild animal jumped out of the window and scratched me!" Sure enough, his face was all bloody.

"That was Old Scratch!" yelled

THERE WAS A COP HOLDING TWO MEN BY THE COAT COLLARS

Thorne. "He was scared of a phonograph."

"Well, what the—" said the cop and stopped.

"Brethren," said the preacher, "I tell you some one is in agony up in that flat. I heard them groan."

Just then the front window went up with a bang. Thorne's sister screamed "Burglars! Help! Help!" And out came a lot of water. It went all over us.

Then a lot more half dressed neighbors came and also a wagon with about ten policemen. Also the fire department. We all went up stairs. When the lights were switched on there was Thorne's sister in her night gown. She had another bucket of water.

"Burglars," she gasped.

"Where?" asked one of the cops.

"There were some down in front of the house a minute ago," she panted, "and there were some in the back yard, and there were several on the back porch. They opened the kitchen window. And oh! there was a crazy one under my bed. He must have escaped when I was out in the kitchen closing the window."

"That was only my burglar alarm under your bed," cried Thorne.

"So!" exclaimed his father, "It was you again, was it? Another one of your fool inventions, I suppose. What are you doing with that mask on?" And he started towards Thorne with a peculiar light in his eye.

Chemical Flasks From Electric Bulbs

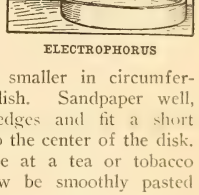
Those interested in electricity are frequently also interested in chemistry, and find it necessary to keep on hand a goodly number of flasks. Anyone who possesses some burned out incandescent bulbs can readily transform them into flasks, the various sizes of bulbs making flasks of different dimensions.

The base of the globe should be held in a flame until the binding material has softened sufficiently to allow the brass part to be pushed off. After cleaning the glass, a sharp file should be used to make a scratch around the glass just back of the place where the little filament tube is sealed in. A sharp glancing blow with the file will then break out the end, leaving a round hole. The edges should be held in a hot flame until they are soft, when they may be smoothed over and formed into a lip. After this has been done, the large end should be held in the flame until it softens, when if it is pressed down on a dry board the bottom will be flattened out so that the flask will stand steadily.

To anneal, the flask should be placed in a pan of strong salt water, gradually allowed to come to a boil, and then set aside to cool.

To Make an Electrophorus

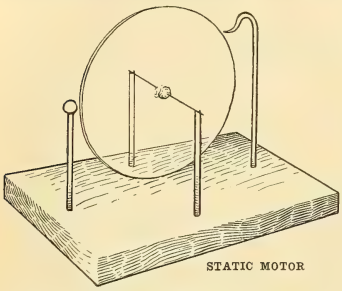
A simple piece of apparatus for experimenting with static electricity is the electrophorus. It may be made as follows: Take an ordinary tin dish and after melting in an iron dish two parts of resin and one part of gum shellac in such a quantity as to nearly fill the tin, pour into the tin and let cool. Next make a wooden disk a little smaller in circumference than the dish. Sandpaper well, round off the edges and fit a short wooden handle to the center of the disk. Tinfoil obtainable at a tea or tobacco store should now be smoothly pasted over the entire surface of the disk. Over the wooden handle should be tightly fitted a glass rod or bottle. In using the electrophorus rub the resin with a piece of flannel or fur, then place the disk firmly upon the resin. Touch the tinfoil for an instant with the other hand. Upon removing the disk with one hand and bringing the finger of the other hand close to it, a very good spark will jump to the finger.



ELECTROPHORUS

A Static Motor

To those interested in electricity, static energy has always had a peculiar fascination, even in spite of the fact that experiments in it are not likely to result in anything that can be placed to mechanical advantage. And yet these experiments are always interesting.

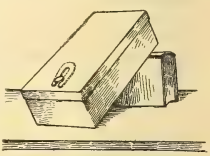


STATIC MOTOR

The static motor is a simple instrument, and will well repay the amateur for the slight labor its construction involves. A disk of mica about 4½ inches in diameter should be secured, with a large needle acting as the axis, the ends of which rest loosely into indentations near the top of two vertical brass rods. Little pieces of wax, or two small wooden disks, will hold the mica securely to the needle. An insulated brass ball placed opposite the horizontal diameter of the mica disk, as closely as possible to its edge, and a pointed conductor at the opposite side, complete the arrangement. The ball and point are then connected, respectively, with the opposite poles of a static machine in operation, when the mica disk will revolve at a speed of about 2,000 revolutions a minute, developing considerable momentum.

The Magic Toboggan Slide

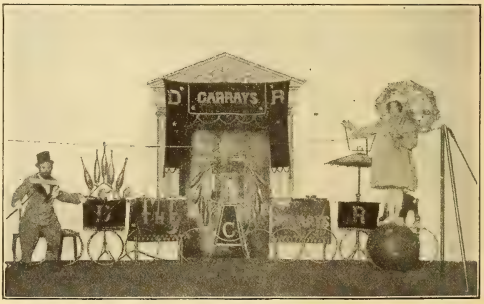
Much wonderment and fun may be created with the magic toboggan slide. The slide consists of an ordinary pasteboard shoe box and a small horseshoe magnet fastened with a little glue upon the inside of the cover as in the illustration. A piece of tin cut in the form of a circle to avoid sharp corners and with edges carefully smoothed serves as the toboggan. With the box set on a slant the disk when started at the top will slide down until it nearly reaches the lower edge of the cover and there stop, much to the surprise of those not in the secret.



MAGIC TOBOGGAN SLIDE

Electricity Introduces Juggling Act

The use of pleasing electrical effects to introduce a novelty juggling act is presented in the accompanying illustration. The Carrays open their act with Mrs. Carray upon a large rolling globe, where she is as much at home as upon the floor. In her hand she carries a parasol attractively trimmed with numerous electric lights. This rather unexpected in-

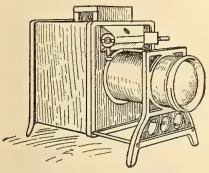


A NOVEL JUGGLING ACT

troduction gains attention and is followed by clever slack wire, club and hoop work.

Projecting Postcard Pictures

In using photographs, postcards, newspaper and magazine clippings in a projecting apparatus to produce enlarged images on a wall or screen, the difficulty has been in obtaining a very bright white light. This difficulty is overcome in the Victor postcard projector by using an arc light. The arc is hand fed and arranged to keep the arc automatically where it belongs. Five feet from the screen a 2½ foot image is made, while 30 feet from the screen a fifteen foot image is produced. The machine is only 9 by 12 inches and is finished in nickel plated trimmings.



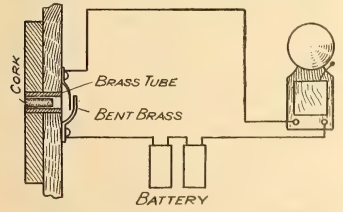
POSTCARD PROJECTOR

Electric Bell Attachment for Dart Board

In playing the game of darts arguments arise as to whether the person playing is entitled to the number limited by hitting the cork center. To settle this question secure a piece of brass tubing about ½ inch in diameter and long enough to go through the board. Force the brass tube through the board, making it to fit firmly. File the ends off the tube even with both surfaces of the board.

Secure a cork which will fit the tube, but be loose enough to move readily. On the back of the board across the hole fasten strips of brass slightly bent as shown. These two strips form contact points to which are fastened the copper wires of a bell and battery. Hitting the cork forces it through the tube with enough momentum to push the contacts together, thus ringing the bell.

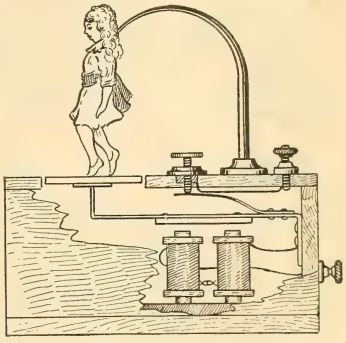
STANLEY HELVERSON.



ARRANGEMENT OF DART BOARD ALARM

The Dancing Doll

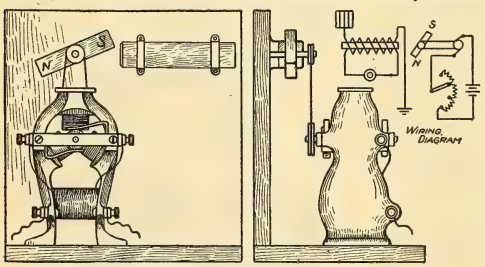
The dancing doll and apparatus shown in the accompanying illustration may be readily constructed from the mechanism of an ordinary electric bell and a neatly made wooden box. The magnets, contacts, armature and hammer arm should be placed as shown. A small circular or square platform is cut from the box and fastened to the bell hammer arm. Upon the top of the box is fastened a curved spring supporting the figure. The joints of the hips and knees should be quite loosely fastened and the figure suspended so that the feet just touch the movable platform. With one or two dry cells the platform will vibrate rapidly, causing the doll to do many fantastic steps.



THE DANCING DOLL

The Magnetic Detector

The magnetic detector, invented by Marconi and much used by his stations, is unlike all other detectors and possesses many good points. It has been little used by experimenters, perhaps for the reason that it is necessary to have a motor, clockworks or other motive power to run it. But the main point in its favor is that it needs no adjustment and that if a message is within its range it will pick it up at once. No adjustment which may result in a partial loss of the message is necessary. The following directions will explain construction of a simple form of this detector.



MAGNETIC DETECTOR

A core about ⅜ inch in diameter and two inches long should be constructed of small iron wires. Bind tight and insulate with a layer of paraffin paper. On this wind about eight feet of No. 23 copper wire and insulate with paraffin paper. Then over this wind another layer of the same amount and size of wire. Leaving the four terminals free, the whole may be covered for mounting. The figure shows a good arrangement of this detector.

An "L" shaped base should be constructed, and the coil mounted. Just opposite the end of the coil a bar magnet about one inch long is mounted on an axis and connected to a small pulley with both free to rotate just in front of the core. Below and connected by a belt to this magnet is placed a small battery motor. The remaining space is occupied by a rheostat switch with which to regulate the motor.

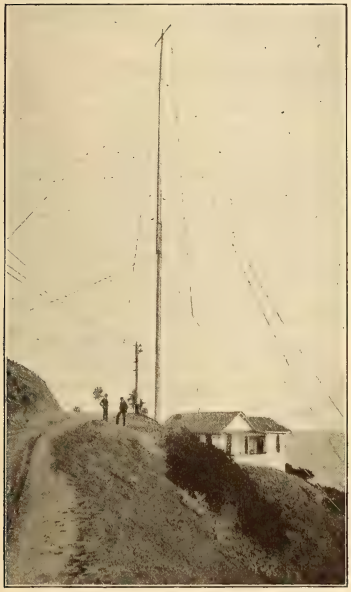
The connections are shown in the diagram, one layer of the coil being connected direct to the phones and the other to the aerial and ground. Any tuning apparatus may be inserted between the aerial and coil. One battery is sufficient to run the motor and should give the magnet a speed of about 30 revolutions per minute.

A few words as to the theory may be well. The slowly revolving magnet before the soft iron core causes magnetic changes within the core. But these changes, due to a peculiar property of the iron, lag behind, thus not causing much current in the coil. But if this iron be subjected to electrical oscillations the effects of this magnetic hysteresis are reduced. So when the message is sent the oscillations travel down the aerial to the coil and have the above explained effect upon the core. Under this influence the core is readily affected by the revolving magnet and these changes of magnetism in the core produce a current in the coil, and is heard in the receiver.

M. Miller.

Wireless at Catalina Island

As the steamer slowly rounds a point and into the beautiful bay at Avalon, Catalina Island, Cal., the first thing to catch the visitor's eye is the tall mast and aerial system of the Avalon wireless station. This is wonderfully placed on a steep, rocky bluff, overlooking the city and ocean, and seeming to come up directly over the clear blue water of the bay. At the foot of the mast a neat



WIRELESS STATION ON CATALINA ISLAND

white cottage is seen, and perhaps the crash of the transmitting spark is carried faintly over the water to the incoming steamer.

Catalina Island—well termed "The Magic Isle"—is situated 22 miles off the coast of Southern California, making an enjoyable two hours' trip by steamer from Los Angeles. This island is the permanent home of several hundred people and is visited each year by thousands of tourists.

One of the most interesting points about this lovely resort is that its only means of communicating quickly with the mainland is by wireless telegraph. No submarine telephone or telegraph cables connect it with Los Angeles—all messages are transmitted by wireless.

The wireless company maintains an office in the city which is connected with the station by telegraph and telephone. Commercial messages are taken here and sent by wire to the operator far up on the hill.

The station is a standard two kilowatt, 60 cycle set, and on account of its exceptionally good location above the city and bay, has a range of about 500 miles. However, practically all of the Island's wireless business is with the Los Angeles stations and the two steamers which run between Avalon and the mainland.

Wireless Hints

Two small strips of brass across the aerial and ground binding posts of your receiving set, forming a lightning gap, may be the means of saving your condenser or phones or perhaps both in case of a hard thunderstorm.

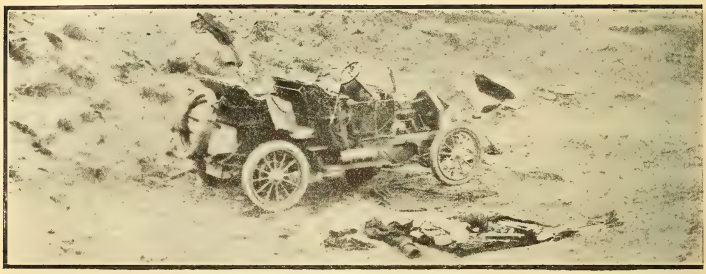
A telephone cam makes an excellent quick action short circuit switch for your detector.

When wiring your receiving set use No. 20 green silk lamp cord. It makes a neat and well insulated job.

A rotary spark gap would increase your radius fully 20 per cent. Why not make one?

To break or cut off a piece of wire when no pliers are at hand lay the wire upon the sharp edge of a piece of iron and hammer lightly. After a V-shaped dent is made in the wire it can be readily broken off.

Don't take your wireless down in the summer time, but ground your aerial outside the building. N. E. Hour.



THE LAYOUT AT A DESERT STATION

Testing Wireless in the Desert

By JESSE H. BUFFUM

A forward step in portable wireless telegraphy is signalized in the recent remarkable automobile tour conducted by the Buffum brothers, who recently won national recognition by their notable pedestrian trip from Boston to Los Angeles, one walking on meat diet, the other subsisting on vegetables only.

Shortly after reaching the Pacific coast at the termination of their long hike, the two brothers, Warren H. and the writer, organized a unique enterprise based on an automobile tour carrying a wireless telegraph set of exceptional power. Their intention was to penetrate the desert regions of southern California in the direction of the Salton Sea, endeavoring to keep in communication, direct or by relay, with their starting point.

For this purpose two automobiles were employed, one a seven passenger 45 horsepower car, principally for the conveyance of the personnel of the party; the other equipped with the wireless apparatus and carrying, besides the driver, the wireless operator. In the forward part of this car was the dynamo, or alternator, while in the tonneau beside the operator the transmitting and receiving sets were permanently secured.

The party consisted of the two Buffum brothers, projectors of the idea and organizers of the tour; J. B. Walker, a wireless apparatus expert and operator; Darwin B. Hull, factory expert in charge of the two automobiles; Geo. Meehans, mechanician, and Warren Vance, agent for the make of cars used.

The party left Los Angeles on February 28, returning eleven days later, having covered about 900 miles on a most remarkable tour over bad roads and through desert sands, including in the itinerary the crossing of the border into Old Mexico, where the advent of the wireless in troublous times gave rise to speedy suspicion.

What at its inception promised to be a very important experiment was unfortunately entirely misrepresented by a scare-head, false report advertising campaign built up about the trip, and through no fault of the Buffum brothers. But in spite of this the trip bore scientific fruit important enough to give to the world.

A rather new feature in portable wireless, an interest in which it is hoped will be stimulated by what we achieved, is the use of kites for elevating the aerials. Two Bluehill type box kites, labeled No. 8 in size, were carried along. Only once on the tour were both employed at the same time. Twice the kite attained a

PREPARING A SET-UP BY THE OCEAN SIDE

height of 600 to 800 feet, remaining at that altitude five hours steadily. Throughout, a No. 0 stranded picture wire served as kite string and antennæ in one.

Desert conditions were found usually bad for kite flying. Radiation seriously interfered with sustaining the kite in the air currents prevailing at a given height. Once the effort was made to raise the kite to this strata, on the desert, by attaching the kite string to the automobile and speeding along until 1,000 feet of wire was played out. The experiment was unsuccessful.

The equipment in detail as carried on the tour is of interest as throwing light on practical field work.

Transmitting: The spark system of transmission was employed. The transformer, which was of the closed core type, developed one-half k.w. This stepped up the 110 volts to 22,000 volts. The energy supplied to the transformer was 60 cycle, 110-volt alternating current, supplied by a generator mounted on the car, belt-driven from the engine of the automobile. The high tension condensers were the Murdock molded type, which were chosen on account of their compactness, ease of handling and great efficiency.

It was easy to see that an ordinary helix would be out of the question on account of space economy, so the "pancake" type was used, invented by Dr. DeForest several years ago, and built by J. B. Walker, of Los Angeles, who himself is originator of several improved pieces of wireless apparatus.

Receiving Circuit: No wireless receiving outfit is stronger than its detector. Special care was taken to have the best possible instrument of its kind, which was the crystal rectifying type, the mechanical design and application of the principle being the work of our operator, Mr. Walker.

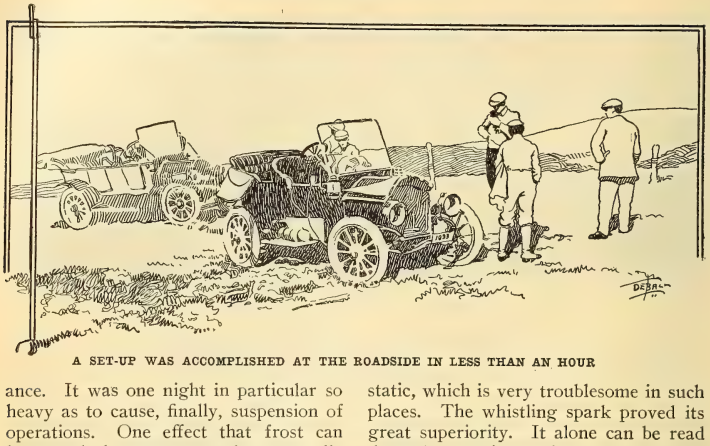
The receivers were a 3,000 ohm Murdock head set, with the variable and fixed condensers of the same make.

The standard loose-coupled receiving transformer was employed.

The full power of the generator was never utilized. The alternater, a 1¼ k. w. special design, built in Los Angeles, was intended to develop 70 volts at 1,750 revolutions. It was often run, however, at 2,100 revolutions and developed 110 volts. This current was passed through a 400 watt transformer that therefore had to carry at times 700 watts. The condensers were so overloaded that on one occasion several sections were "shot."

A sectional pole, carried on special brackets on the smaller car, made of 1½ inch material, soft wood, spliced roughly by bolting together when erecting. Five ten-foot sections gave an approximate height of 48 feet. Rope guys from the middle and top gave ample stability.

One of the discoveries of the trip was that frost can give surprising annoy-



A SET-UP WAS ACCOMPLISHED AT THE ROADSIDE IN LESS THAN AN HOUR

ance. It was one night in particular so heavy as to cause, finally, suspension of operations. One effect that frost can have and that may not be generally known is to create trouble in the receiving apparatus by coating the silicon, as happened in this case. The remedy was to use two pieces of the crystal, warming one while the other was in use.

Moisture as well as frost, and of course more frequently, is a fruitful cause of trouble in the open, and characterizes portable difficulty. With the air full of moisture the leakage from the high voltage circuit of the transformer was so great that a person touching the metal parts of the car would receive at any time a severe but harmless shock. This leakage took place in the form of invisible brush discharge.

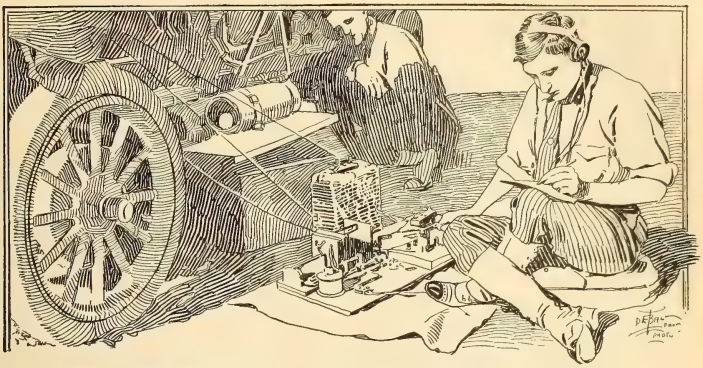
It was found that the variable climatic conditions encountered by the car in its travels rendered it difficult to keep the belt driving the generator at proper tension. It was found that as a remedy for this an idler is invaluable.

Anent the position taken by numerous experts, particularly government operators, we found that the whistling spark, and next to that the rotary gap, is heard with a pronounced clearness compared with the 60 cycle spark. The latter cannot be read well over desert and mountainous country, on account, largely, of static, which is very troublesome in such places. The whistling spark proved its great superiority. It alone can be read through excessive static.

Careful observation led to the conclusion that a spark operating at 600 cycles would be far better for cross country transmission, particularly where mountainous and desert in character.

What has been largely a mathematical theory, not much proven in practice, we checked up on to our entire satisfaction, viz., that long wave lengths across dry (desert) country reach more effectively than short wave lengths.

The total distance traveled on the trip approximated 900 miles. Six set-ups were made, varying in distance from each other from 50 to 100 miles. Most of the trip was made, much against the wish of the Buffum brothers, outside the distance the set carried, and but few messages were picked up that we sent. A few ships at sea and one or two government stations picked us up, as did an amateur or two, but never when we were more than 100 miles distant. On our part, we picked up messages from almost unbelievable distances, including San Francisco; and we listened in on one three-cornered conversation between Point Loma, San Francisco, and a third party so far away that I guess I'll not hazard a guess, publicly, at its identity.



IN OLD MEXICO LISTENING TO MARE ISLAND NAVY YARD NEARLY 800 MILES AWAY

Once, on the desert, we heard San Francisco when we had no ground, but were using at the moment our kite.

Unique in automobiling was our equipment for lighting and cooking by electricity. Generating our own current wherever we went, we strung our electric lights out over the sage brush and cacti, startling the natives who flocked around awed by the sight; and, to add to the wonder of it all, with our little electric stove prepared hot suppers on dreary deserts and amid the vast silences of the majestic hills. The little 1¼ k. w. generator gave abundance of power.

San Francisco Hears Wireless from Korea

On February 28th last, Operator Kessler in the Hillcrest station of the United Wireless Telegraph Company, San Francisco, was checking up some messages he had dispatched and received. Suddenly, at 1:30 a. m., he detected in his wireless receivers a faint and strange call for a station. Listening intently, and carefully adjusting his tuning instruments, he made out the call to be "J O I." Realizing that he was in touch with far distant Korea, he pressed the receivers closely to his ears and very shortly the dots and dashes resounded as clearly and distinctly as if they were being transmitted by a station only a few hundred miles away. When the sounds had ceased, he looked back over his sheet and read the following message: "English consul sends greetings to operator and says that the new wireless is a great success. (Signed) J. O. C."

Hardly believing that this message came from far away Asia, the matter was reported to the main office of the United Wireless Telegraph Company. In order to have the occurrence authenticated, a cablegram going fully into details was forwarded to the Japanese authorities. They responded the same day, verifying the accuracy word for word of the entire message.

The Japanese government had just completed the erection and installation of a powerful wireless station on the peninsula of Korea, and it was on the occasion of the opening of this that the message was dispatched to the station at Hakodate in the northern part of Japan.

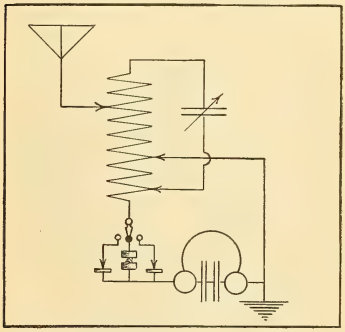
Several months ago Mr. Kessler made a record by "picking up" signals transmitted by the Hakodate station. The

new Korean station is 5,390 miles from San Francisco, whereas Hakodate is 600 miles nearer.

Hillcrest station in San Francisco is finely situated. It is located on the top of a hill 300 feet above sea level, close to the southwesterly limits of the city, and although several miles inland from the beach it has an unobstructed view of the ocean. The station is equipped with the standard sending and receiving apparatus of the United Wireless Telegraph Company. The power used in transmitting is either five or ten k.w., as occasion requires. The masts for supporting the aerial are 200 feet high, being equal in height to the standard masts adopted by the Navy Department for its coast stations. W. ZACHERT.

Hook-up for Long Distance Work

A comparison of the long distance receiving accomplished by the amateur several years ago and the amateur of



WIRELESS HOOK-UP

today will in every case show a marked increase in range. It was but a short time ago that the majority of the experimenters in and around Chicago believed themselves to be obtaining good results upon hearing the commercial stations at various ports on the Great Lakes, but now it is not an unheard of occurrence for them to pick up commercial stations on the Atlantic Coast.

The hook-up illustrated in this article is identical with the one which I have used all winter and has given excellent results in long distance work and in selectivity. My receiving set consists of a large triple slide, bare wire, tuner, a Murdock silicon detector, a Ferron detector, a galena detector, a rotary variable condenser, a fixed condenser in steps and a pair of Brandes navy type phones shunted around a fixed condenser. My aerial is 84 feet high, being suspended from a pole 44 feet high, and consists of six No. 12 aluminum wires on eight foot bamboo spreaders and is 175 feet long. Running in the opposite direction I have one long wire 400 feet in length which has proved of great value for long distance work.—JESSE JAY.

High Power Navy Equipment

The high powered Navy wireless station now building at Arlington, outside of Washington, which will be in operation next month, uses a power of 100 kilowatts and has a range of 3,000 miles with a wave length of 4,000 meters.

WIRELESS ON FISHING BOATS

Small wireless telegraph outfits are being fitted on several fishing boats in the French waters about the Channel, and what is needed here is a simple apparatus which is not expensive and above all to have it operated by the men on board so that a special man need not be employed, as this would be too great an addition to the boats' expenses. An apparatus of the kind is designed by Engineer Bethenod which works for 200 miles in the daytime or 500 at night, and uses a mast running to 60 feet above the water line. At Boulogne, one of the fishing centers on the Channel, there are wireless and mechanical courses organized for the fishermen, and after three months the student has his diploma and engages on board with a slight raise of salary.

Directory of Wireless Clubs

This directory of amateur wireless clubs and associations will be published each month. When a new club is formed the names of the officers, also the street address of the secretary, should be forwarded to us at once. Any changes that should be made in the directory, when designated by an official of a club, will be made in the next issue after receipt of such advice.

Aerogram Club.—J. Stedman, President; A. Hayward Carr, Chairman Board of Directors; Albert S. Hayward, Treasurer; Donald P. Thurston, Secretary; Walter B. Clarke, 17 May St., Newport, R. I., Corresponding Secretary.

Aerograph Club of Richmond, Ind.—H. J. Trueblood, President; Richard Gatzek, Vice President; James Pardieck, 320 South 8th St., Richmond, Ind., Secretary.

Aero Wireless Club.—A. Garland, President; W. Ladley, Vice President; D. Beard, Napa, Calif., Secretary and treasurer.

Allegheny County (Pa.) Wireless Association.—Arthur O. Davis, President; Theodore D. Richards, Vice President; James Seaman, Leetsdale, Pa., Secretary and Treasurer.

Alpha Wireless Association.—L. L. Martin, President; F. A. Schaeffer, Vice President; G. F. Girton, Box 57, Valparaiso, Ind., Secretary and Treasurer.

Amateur Wireless Association of Schenectady, N. Y.—D. F. Crawford, President; L. Beebe, Vice President; C. Wright, Treasurer; L. S. Uphoff, 122 Ave. "B," Schenectady, N. Y., Secretary.

Amateur Wireless Club of Geneva (N. Y.).—H. B. Graves, Jr., President; C. Hartman, Vice President; L. Reid, Treasurer; Benj. Merry, 148 William St., Geneva, N. Y., Secretary.

Berkshire Wireless Club.—Warren A. Ford, President; William Yarkee, Vice President; Charles Hodecker, Treasurer; Jas. H. Ferguson, 18 Dean St., Adams, Mass., Secretary.

Canadian Central Wireless Club.—Alexander Polson, President; Stuart Scorer, Vice President; Benj. Lazarus, P. O. Box 1115, Winnipeg, Manitoba, Can., Secretary and Treasurer.

Cardinal Wireless Club.—K. Walthers, President; F. Dannenfelser, Vice President; Miss A. Peterson, South Division High School, Milwaukee, Wis., Secretary.

Chicago Wireless Association.—John Valters, Jr., President; E. J. Stien, Vice President; C. Stone, Treasurer; F. D. Northland, Secretary; R. P. Bradley, 4418 South Wabash Ave., Chicago, Ill., Corresponding Secretary.

Fargo Wireless Association.—Kenneth Hance, President; John Bathrick, Vice President; Earl C. Reineke, 518 9th St., Fargo, N. D., Secretary.

Forest Park School Wireless Club—W. S. Robinson, Jr., President; William Crawford, R. F. D. No. 1, Springfield, Mass., Secretary.

Frontier Wireless Club.—Chas. B. Coxhead, President; John D. Camp, Vice President; Franklin J. Kidd, Jr., Treasurer; Herbert M. Graves, 458 Potomac Ave., Buffalo, N. Y., Secretary.

Gramercy Wireless Club.—James Platt, President; John Gebhard, Vice President; John Diehl, Treasurer; John Jordan, 219 East 23d St., New York, N. Y., Secretary.

Northwestern Wireless Association of Chicago—Rolf Rolfson, President; H. Kunde, Treasurer; Edw. G. Egloff, 2729 Noble Ave., Chicago, Ill., Recording Secretary.

Hannibal (Mo.) Amateur Wireless Club.—Charles A. Cruickshank, President; J. C. Rowland, Vice President; William Youse, Treasurer; G. G. Owens, 1306 Hill St., Hannibal, Mo., Secretary.

Haverhill (Mass.) Wireless Association—Riedel G. Sprague, President; Charles Farrington, Vice President; Leon R. Westbrook, Haverhill, Mass., Secretary and Treasurer.

Independence Wireless Association.—Royce Miller, President; Ralph Elliott, Secretary; Joseph Mahan, 214 South Sixth St., Independence, Kan., Vice President.

Jonesville Wireless Association.—Frederic Wetmore, President; Webb Virmylia, Vice President; Richard Hawkins, Treasurer; Merritt Green, Lock Box 82, Jonesville, Mich., Secretary.

Lake View Wireless Club.—E. M. Fickett, President; R. Ludwig, Treasurer; R. F. Becker, 1439 Winona Ave., Chicago, Ill., Secretary.

Long Beach Radio Research Club.—Bernard Williams, 555 E. Seaside Bvd., Long Beach, Calif., Secretary.

Manchester, (N. H.) Radio Club.—Homer B. Lincoln, President; Clarence Campbell, Vice President; Elmer Cutts, Treasurer; Earle Freeman, 759 Pine St., Manchester, N. H., Secretary.

New Haven Wireless Association.—Roy E. Wilmot, President; Arthur P. Seeley, Vice President; Russell O'Connor, 27 Vernon St., New Haven, Conn., Secretary and Treasurer.

Oakland Wireless Club.—H. Montag, President; W. L. Walker, Treasurer; W. R. Sibbert, 916 Chester St., Oakland, Calif., Secretary.

Oregon State Wireless Association.—Charles Austin, President; Joyce Kelly, Recording Secretary; Edward Murray, Sargeant-at-Arms; Clarence Bischoff, Lents, Ore., Treasurer and Corresponding Secretary.

Pacific States Wireless Association.—Howard W. Lewis, President; W. N. Hickman, Vice President; Earl C. Hanson, Recording Secretary; Stanley McClatchie, 288 Wilcox Ave., Los Angeles, Cal., Corresponding Secretary.

Peterboro Wireless Club.—G. B. Powell, President; C. V. Miller, Vice President; E. W. Oke, 263 Edgeburn Ave., Peterboro, Ontario, Can., Secretary and Treasurer.

Plaza Wireless Club.—Paul Elliott, President; Myron Hanover, 156 E. 66th St., New York, N. Y., Secretary and Treasurer.

Rockland County (N. Y.) Wireless Association.—W. F. Crosby, President; Tracey Sherman, Vice President; Marquis Bryant, Secretary; Erskine Van Horton, 24 De Few Ave., Nyack, N. Y., Corresponding Secretary.

Roslindale (Mass.) Wireless Association.—O. Gilus, President; E. T. McKay, Treasurer; Fred C. Fruth, 962 South St., Roslindale, Mass., Secretary.

Sacramento Wireless Signal Club.—E. Rackliff, President; J. Murray, Vice President; G. Banvard, Treasurer; W. E. Totten, 1524 "M" St., Sacramento, Calif., Secretary.

Santa Cruz Wireless Association.—Orville Johnson, President; Harold Sentor, Vice President; Harrison Lane, 23 Riverside Ave., Santa Cruz, Calif., Secretary.

Southern Wireless Association.—B. Oppenheim, President; P. Gernsbacher, 1455 Henry Clay Ave., New Orleans, La., Secretary and Treasurer.

Springfield (Mass.) Wireless Association.—A. C. Gravel, President; C. K. Seely, Vice President and Treasurer; D. W. Martenson, Secretary; Club Rooms, 323 King St., Springfield, Mass.

St. Paul Wireless Club.—Thos. Taylor, President; L. R. Moore, Vice President; E. C. Estes, Treasurer; R. H. Milton, 217 Dayton Ave., St. Paul, Minn., Secretary.

Tri-State Wireless Association.—C. B. DeLa-Hunt, President; O. F. Lyons, Vice President; T. J. M. Daly, Treasurer; C. J. Cowan, Memphis, Tenn., Secretary.

Waterbury Wireless Association.—Weston Jenks, President; Alfred Upham, Treasurer; H. M. Rogers, Jr., 26 Linden St., Waterbury, Conn., Secretary.

Wireless Association of British Columbia.—Clifford C. Watson, President; J. Arnott, Vice President; E. Kelly, Treasurer; H. J. Bethel, 2090 Fourteenth Ave. E., Vancouver, B. C., Corresponding Secretary.

Wireless Association of Canada.—W. Fowler, President; E. G. Lunn, Vice President; W. C. Schuur, Secretary and Treasurer.

Wireless Association of Montana.—Roy Tysel, President; Elliot Gillis, Vice President; Harold Satter, 209 South Ohio St., Butte, Mont., Secretary.

Wireless Club of Baltimore.—Harry Richards, President; William Pules, Vice President; Curtis Garrel, Treasurer; Winters Jones, 728 North Monroe St. Baltimore, Md., Secretary.

For Practical Electrical Workers

Transformer Construction

By WESLEY G. PAULSON

The step-down transformer here described is of the "Ferranti" shell type and its efficiency is high. The design is for a capacity of 50 watts with the primary connected to a 110 volt, 60 cycle circuit. Taps from the secondary winding as planned will give 2, 5, 10, 15, 20, 25 and 30 volts.

For the core special transformer iron, or steel if available, should be used.

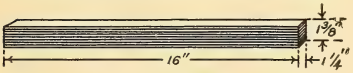


FIG. 1. CORE

However, the thinner gauges of stovepipe iron will serve. In the following discussion, where dimensions are given in the diagrams they will not be repeated in the text.

The core, Fig. 1, consists of a pile of iron strips about 1 3-8 inches high when compressed. Sheet iron will be much improved by annealing, but special transformer iron need not be subjected to that process. To anneal sheet iron, wrap the iron strips in several thicknesses of sheet asbestos and bind with a few turns of heavy wire. Place the iron in the stove at night and allow it to reach a red heat, then gradually cool as the fire dies out.

After the iron is thoroughly cool, mix up some thin shellac (by dissolving in alcohol shellac gum obtainable at a drug store). Dip half of the iron strips in the shellac and set them up to dry. In assembling the core, one of these shellac coated strips is interposed between each two bare iron laminations.

The spool or bobbin for the windings is made of fiber or heavy cardboard, in the preparation of which a wooden block or form will be required. Cut a block of wood as in Fig. 2. Wind a strip of paper around the block four or five times, which will compensate for any little inaccuracy in cutting the laminations. It will also facilitate removal of the bobbin from the form after the windings are in place. Cut a piece of 1-16 inch fiber or heavy cardboard as in Fig. 2. Soften

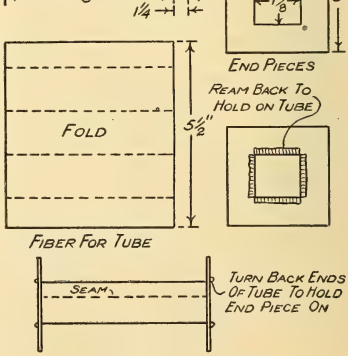


FIG. 2. SPOOL OR BOBBIN

by soaking in warm water for a moment or two and then bend tightly around the wooden form, starting so that the lap seam will be in the middle of one of the sides of the form. Secure the joint

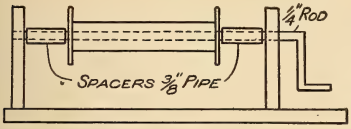


FIG. 3. COIL WINDER

with glue or thick shellac and slip on one or two rubber bands.

Two fiber pieces are now cut to the dimensions shown in Fig. 2, to slip on each end of the bobbin tube. Slip the two end pieces in place on the tube and make a large number of small cuts in the ends of the tube with a sharp knife and ream or turn back against the end pieces, securing with thick shellac or glue.

If a lathe is available the winding process will be greatly facilitated. Otherwise a very satisfactory arrangement can be improvised as shown in Fig. 3.

The secondary coil is first wound in place and consists of 246 turns of No. 14 gauge, double cotton covered copper wire. Nearly two pounds will be required.

Make a hole in one of the end pieces as shown at (A), Fig. 4, through which pass about eight inches of the No. 14 secondary wire. Cut also six pieces, each about ten inches long for taps. Proceed to wind the wire carefully and evenly up to the seventeenth turn. A tap is brought out here for two volts through a hole in the end piece at (B), Fig. 4. At the seventeenth turn, mark where the tap is to be attached, then unwind two turns and bare the insulation for half an inch. Push back the insulation at the end of one of the taps, and hammer the copper flat for an inch or so from the end, then twist this flattened end tightly around the bare copper of main winding and solder in place. Bind carefully with tape, which should be varnished over with shellac. Be careful that the joint is thoroughly insulated.

At the 41st turn, another tap is brought out in the same manner for five volts, excepting that it is to pass out through the hole (C) in the end piece. At the 82nd turn another tap is brought out for ten volts, through the hole (D). At the 123rd, 164th and 205th turns taps are brought out through the holes (E), (F) and (G) in the opposite end piece, for 15, 20 and 25 volts. On the end piece should be marked above the taps the different voltages so there will be no confusion as to which tap is which. At the 246th turn, which will give a voltage

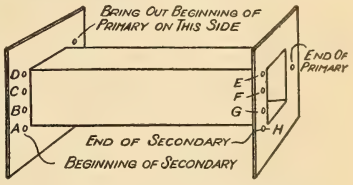


FIG. 4. BOBBIN READY FOR WINDING

of 30, the wire is then cut and about a foot brought out through the hole (H).

Each layer as completed should be varnished over with shellac. The insulation in the secondary must be thorough and without a break at any point.

As the primary winding is placed over the secondary, adequate insulation must be provided between the two windings. After shellacking the secondary, wrap a layer of cardboard or heavy wrapping paper around it, securing it with a couple of layers of tape well varnished over with shellac.

The primary winding is next applied, and may be wound in the same direction as the secondary. The primary consists of 900 turns of No. 23 gauge, double cotton covered wire which will weigh about a pound. Each layer as completed is to be varnished over with shellac. Make a hole in the bobbin end piece on the side just opposite to that on which

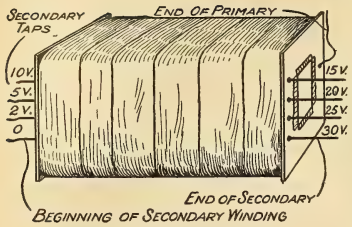


FIG. 5. WINDINGS COMPLETED

the hole (A), Fig. 4, was made. This is shown in Fig. 5. The end of the primary winding is brought out of the same side of the opposite bobbin end. Varnish over the last layer in the primary well with shellac, wind around two thicknesses of heavy wrapping paper and bind in place with a layer of tape well shellacked.

In mounting prepare a baseboard preferably of slate or asbestos of the dimensions given in Fig. 6, and a yoke by means of which the transformer is bolted down on the base and a switch. For the latter a piece of 1-16 inch phosphor bronze will serve best. For contact

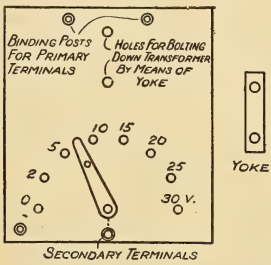


FIG. 6. SWITCH AND CONTACT POINTS

points the writer used brass headed paper fasteners to which the ends of the taps were soldered, on the under side of the baseboard. Four binding posts are placed on the baseboard, two for the primary and two for the secondary terminals. The switch and contact points are also shown in place in Fig. 6.

Now slide the bobbin on the core, with the taps on the side, as shown in Fig. 7. The ends of the laminations are bent half over, and half underneath the bobbin as shown in Fig. 8. Bend the strips one at a time, lapping the ends to make a good magnetic joint. Make sure and wedge the bobbin so it fits tightly on the core. The transformer is now bolted down tightly on the base, as in Fig. 9. Bore holes and cut grooves in the under side of the board for the connections.

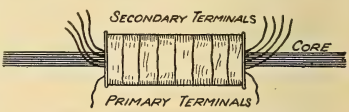


FIG. 7. BOBBIN MOUNTED ON CORE

The wiring scheme is shown in Fig. 10. Sliding the switch over the contact points will give a range of from 2 to 30 volts. The switch must not touch two contact points at the same time.

For service on a 220 volt circuit, the primary should consist of twice as many turns of smaller wire; that is, 1800 turns of No. 25 gauge with the same secondary. For 52 volts, with the same secondary windings, use 450 turns of No. 20 wire.

The writer has built and operated with complete success this 50 watt unit as described. The design is liberal and the transformer will stand a considerable overload. The primary connections are to be made direct to the supply mains without the use of any resistance or impedance. Possibly, some may desire other secondary voltages than those given. In this connection it should be

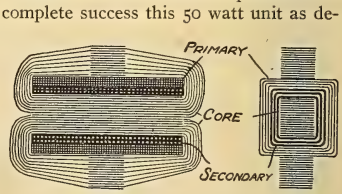


FIG. 8. CORE LAMINATIONS BENT OVER

noted that about every eight turns in the secondary windings will give an electromotive force of one volt. Therefore any voltages may be arranged for by bringing out taps from the secondary at any desired multiple of eight turns.

Some may desire a larger transformer, and data is here given for a 100

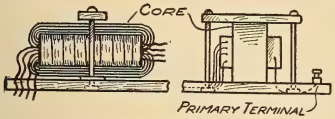


FIG. 9. TRANSFORMER BOLTED TO BASE

watt unit of the same type, the method of building being the same as already described.

The core laminations are to be cut 18 by 2 inches, and enough provided for a pile 1¼ inches high when pressed tightly together.

The bobbin should be six inches long. Make a wooden form six inches by two inches wide by 1½ inches thick, on which the bobbin is constructed. Cut

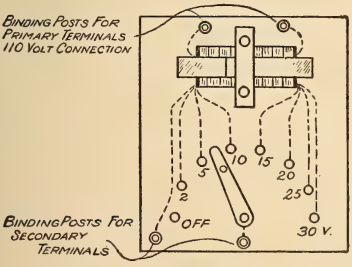


FIG. 10. WIRING SCHEME

the fiber or cardboard for the tube, 7½ by 6 inches, making the lap or seam in the middle of one of the sides. The end pieces should be about 3¾ by 4¼ inches. The hole in the center of the end pieces, for the tube, is cut 1⅝ by 2⅛ inches.

The secondary consists of 138 turns of No. 10 double cotton covered wire, of which between two and three pounds will be required. The No. 10 wire is very heavy and stiff, and it would be much easier to use two strands of No. 13 wire wound side by side. This will have practically the same carrying capacity as one strand of No. 10.

Taps should be soldered to both of the No. 13 wires and be brought out as follows:

At the 9th turn for two volts, at the 23rd turn for five volts, at the 46th turn for ten volts, at the 69th turn for fifteen volts, at the 92nd turn for 20 volts, at the 115th turn for 25 volts, at the 138th turn for 30 volts. About every five turns will give a secondary e. m. f. of one volt.

The primary winding consists of 500 turns of No. 20 double cotton covered wire wound over the secondary with adequate insulation between the two windings. Each layer of the primary as well as the secondary should be varnished over with shellac as wound. For other supply voltages, retaining the same secondary winding, the primary should consist of 260 turns of No. 17 gauge for a 52 volt circuit, 1,000 turns of No. 23 gauge for a 220 volt circuit.

A low voltage transformer is very convenient to operate small electrical toys and to ring bells. A late application is to have a small low voltage light mounted on the door casing so as to cast its rays on the keyhole. Such a light can be connected in parallel on the regular door bell circuit with a separate push button if a small step-down transformer is used on the bell circuit. A lamp of the same voltage as that supplied by the transformer must be used. The full arrangement is shown in Fig. 11.

Last Christmas the writer made a small switchboard with separate switches for lamps of each color, by means of which all the red lamps could be lighted at once, then the blue, the white, the green and the yellow, and finally any combination or all together. The effect was very pleasing. The wiring scheme is shown in Fig. 12. Regular fourteen

volt lamps connected together in parallel and supplied by a fourteen volt tap from a step-down transformer, were used. A separate line was run into the tree from each switch for the lamps of each color, and one common or neutral line was pro-

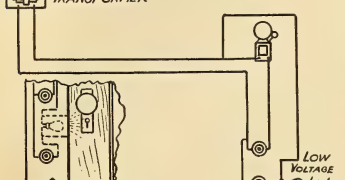


FIG. 11. TRANSFORMER USED AS BELL RINGER AND FOR LOW VOLTAGE LAMPS

vided to which the other terminals of all the lamps were connected.

Low voltage lamps will be found very convenient about the home, as in the dark room, the pantry, the closets, the cupboard, the refrigerator, in front of the alarm clock in the bedroom and on the sewing machine. If desired, a switch can be very easily arranged to switch on the light when a door is opened.

Bare the thick lead for about an inch at the ends of two drawing pencils. At the other ends cut two notches through

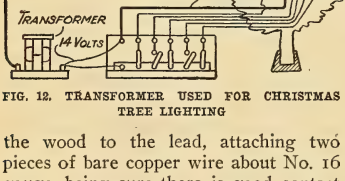


FIG. 12. TRANSFORMER USED FOR CHRISTMAS TREE LIGHTING

the wood to the lead, attaching two pieces of bare copper wire about No. 16 gauge, being sure there is good contact between the copper and the graphite. Applying ten or fifteen volts pressure bring the points of the pencils together and then withdraw them slightly. A dazzling arc will result. Twenty or 25 volts will consume the pencils rapidly.

Charges of powder, flashlight mixtures or explosive gases may be fired very safely with low voltage current. Use No. 32 iron wire, a spool of which may be obtained at any five or ten cent store. Run two No. 16 gauge wires from the transformer over to the powder, between the ends of which connect a piece of the iron wire two or three inches long. Imbed this in the powder to be fired, then move the switch over to the five or ten volt tap on the transformer and the small piece of iron wire will instantly fuse, igniting the powder.

Twist about two feet of No. 28 Calido wire around a piece of glass tubing, Fig. 13, to be bent, winding the coils close

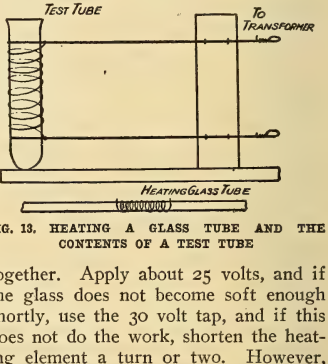


FIG. 13. HEATING A GLASS TUBE AND THE CONTENTS OF A TEST TUBE

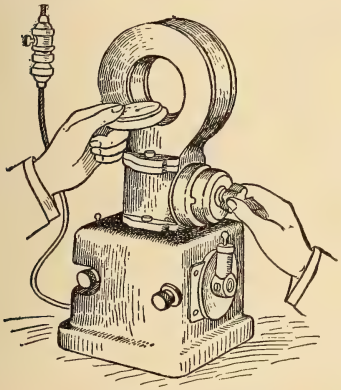
together. Apply about 25 volts, and if the glass does not become soft enough shortly, use the 30 volt tap, and if this does not do the work, shorten the heating element a turn or two. However, if the temperature is raised too high, the wire will simply fuse and melt at some point.

Take a test tube, Fig. 13, and twist around the top of it one end of a piece of bare No. 16 gauge copper wire about a foot long. Twist another piece around the bottom. Measure off about two feet of No. 28 Calido wire. Attach one end securely to one of the copper wires by twisting tightly several times. Then wind the Calido wire around the test tube, in a helix up to the other copper

wire to which the end is to be secured as shown in Fig. 13. Fill the tube with the fluid it is desired to heat, and connect to the transformer terminals. Twenty-five or 30 volts will soon bring the fluid up to the boiling point.

Watch Demagnetizers

Those who carry a watch while working about dynamos, motors or in electrical laboratories soon find their timekeeper inaccurate. The steel of the watch has been magnetized. To demagnetize it, the watch must be placed in a field of magnetic lines produced by alternating current and withdrawn

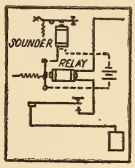


WATCH DEMAGNETIZER

slowly. The Green automatic demagnetizer shown in the accompanying illustration consists of a motor driven alternator that sends current back and forth around the coil at the top. The circular opening is thus filled with lines of force that change direction as often as the current alternates in the coil. By placing the watch at the center of the coil, starting the motor and slowly withdrawing the watch, it becomes demagnetized. The device is powerful enough to demagnetize a steel bar 4 by 2 by 2 inches.

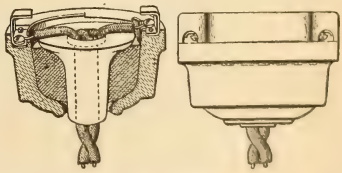
Motor Operated Bell

The Adnil Company of London is making an electric motor driven bell. It is intended to be used where a very loud sound is needed, as in factories, mines or railways, and it is very useful as a fire alarm bell since the sound can be heard above the noise of the machinery. It is operated by the small ironclad motor which is placed under the gong and the motor is very well protected from injury in this position. The "gigantic" bell, as it is called, is made to run either on direct or alternating current. The size of the gong is listed up to 20 inches diameter, but very large ones of a yard diameter are also made for special cases. The same firm has a gas and water tight bell in which the hammer rod is connected to the armature by means of a ball joint embedded in gasoline. This makes the connection quite tight and at the same time allows of an easy movement of the hammer. Such bells give a very loud sound.



Shock Absorber in a Rosette

A shock absorber as a part of an ordinary ceiling rosette from which incandescent lamps are suspended by drop cord is the subject of a patent issued to

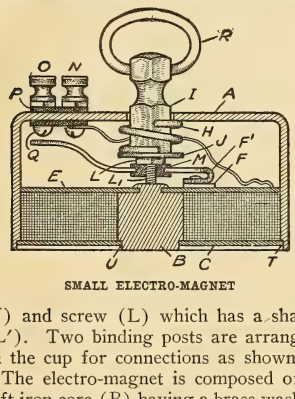


SHOCK ABSORBER

S. B. Paine, Newton, Mass. The cord from the circuit is tied in a knot in the top of a tubular plug which rests upon some elastic material, preferably felt, thus forming a cushion.

Electro-Magnet with Automatic Switch

The magnet here described consists of essentially two parts which when completely assembled form a very neat and practical instrument. The cut is actual size. The outside portion—cover and attachments—consists of a cup shaped shell (A) and a ring (R) fitted into a hexagonal shank (I), which can move up and down slightly, due to the elasticity of spring (H) surrounding (I). The spring is held in place by washer



SMALL ELECTRO-MAGNET

(J) and screw (L) which has a shank (L'). Two binding posts are arranged on the cup for connections as shown.

The electro-magnet is composed of a soft iron core (B) having a brass washer (C) riveted at (U) and a soft iron washer (E) riveted at (L'), the opposite end of core (B). The soft iron washer (F) supports a spring (F') which is insulated therefrom and has a hole pierced at (M). The tendency of this spring is upward. The space on core (B) between the brass washer (C) and the iron washer (E) is wound with No. 22 s.c.c. wire. Core (B) should be insulated by winding on a thickness of good wrapping paper before winding with the magnet wire. Paint the washers on the inside with a good insulating varnish or line with paper. Spring (H) is slightly more powerful than spring (F). The brass washer (C) is riveted to cup (A) at (T), which seals the device. The soft iron washer conducts the magnetism from core (B) to shell (A), which acts as one pole of the magnet, the core acting as the other pole.

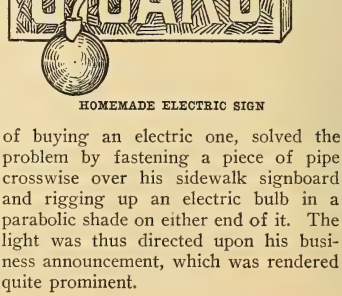
When the binding posts are connected to a suitable battery no action takes place until the device is lifted by handle (R), when the weight of the device acts against the spiral spring (H). At the same time spring (F) rises and makes contact at point (Q). This allows the current to pass from binding post (N), through connecting wire (G) to the coil and out of the coil at (S), through spring (F) and binding post (O).

The device thus acts as its own switch. If the experimenter wishes to lay it aside now and then while experimenting, it is not necessary to disconnect the batteries each time. The act of laying it aside breaks connections at (Q) and saves the batteries from useless discharging.

This device will lift several pounds on one dry cell.—Clarence Hurlbut.

A Homemade Electric Sign

A merchant in a small town, who was confronted with the problem of making his sign luminous without the expense

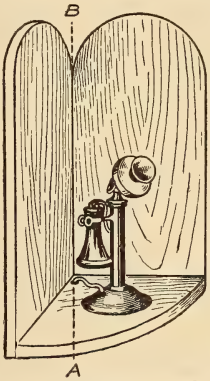


HOMEMADE ELECTRIC SIGN

of buying an electric one, solved the problem by fastening a piece of pipe crosswise over his sidewalk signboard and rigging up an electric bulb in a parabolic shade on either end of it. The light was thus directed upon his business announcement, which was rendered quite prominent.

Increasing a Telephone's Range of Usefulness

It sometimes happens that two people in adjoining offices desire to use the same telephone. If the partition be a light wooden one, this can be accomplished very easily by making use of a swinging shelf as illustrated in the cut. A small opening similar to a cashier's window is cut through, and the shelf is equipped with two sides which just fit into the opening. Both parties thus have the use of the same telephone, while at the same time both offices are entirely private and shut off from each other.

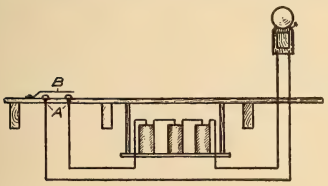


SWINGING TELEPHONE SHELF AND DOOR

A Floor Tread Switch

A simple and effective floor tread switch may be made cheaply in the following manner:

Bore two holes through the floor about 1½ inches apart, at a point where there is the most wear from constant treading of persons coming in or going out the door. Next secure two flat headed brass screws (A) long enough to go through the floor. To each of these fasten an end of copper wire. Tack a piece of tin (B) about 8 by 6 inches directly over the two screws, securing it only at one end as shown. Lay a light rug over the tin, place the bell in any desired position and the alarm is finished. Anyone opening the door and stepping into the hallway will readily be detected.

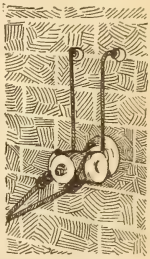


FLOOR TREAD SWITCH

STANLEY HELVERSON.

Neat Fastening for Entrance Wires

Two porcelain insulators on wooden brackets are often provided to anchor a pair of wires where they enter a building. A deviation from this method is presented in the Universal insulator, consisting of a single piece of molded porcelain. Grooved knobs at right angles to the main body form a support for each wire and present a pleasing appearance.


ANCHOR FOR ENTRANCE WIRES

Electro-Plating on Glass and Porcelain

A new method of electro-plating upon glass, porcelain and the like, which is said to give very good results, is the invention of an Italian engineer, Q. Marino, and he obtains an adherent deposit of different metals on such surfaces.

In the first place, the surface of the glass is roughened in the sand blast, then it is covered with a paste made with dyro-fluoric acid and a chloride or other salt of the metal which is to be deposited on the surface. Then the object is put in an electro-plating bath in order to receive a coating of the metal, the deposit taking place on the adhesive conductive paste.

Improvement in Moving Picture Machines

A very ingenious arrangement of a number of tungsten lamps of a special type has been proposed by a French investigator to replace the arc lamp for use with moving picture machines. The arc lamp is objectionable owing to the enormous amount of heat developed which often sets fire to the inflammable films, causing fatal panics in several cases. Aside from this danger there is a further objection, owing to the discomfort of the operator from the excessive heat. In order to clearly describe this proposed arrangement a brief outline of the optics of the subject must be indulged in.

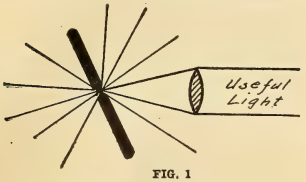


FIG. 1

With every arc lamp used in connection with moving picture machines there are a number of lenses. To us only one lens—the condenser—is of interest. This lens gathers the light rays and sends them in a bundle to the other lenses, as shown in Fig. 1 by the parallel lines. The amount of the total light depends on the solid angle subtended by the lens. Owing to the excessive heat, the lens must be kept at a considerable distance from the arc in order to avoid cracking the lens. It will be noted that the further away from the arc the lens is placed the smaller is the angle subtended, and therefore the less is the amount of light gathered by the condensing lens. In other words, a large amount of the total light is not made use of when the lens is at a considerable distance from the light source. In Fig. 2 is shown a special tungsten lamp of high candlepower, arranged with the condensing lens very close to it. The lamp has a small spiral filament and has a bulb only a half-inch in diameter. It is at once evident that a much greater percentage of the total light is made use of in this case. There is no danger of the lens cracking because there is but little heat developed by the lamp.

The arrangement actually proposed is to place a large number of these special lamps on a wheel with the condenser located as shown in Fig. 3. The wheel is revolved so that a lamp is opposite the lens when a picture on the film is in proper position to be projected on the screen. The lamps are connected so that only the lamp in front of the lens is lighted. In order that the lamps will give a high candlepower they are burned at an excessively high voltage. Being burned only for very short intervals, the life of the lamps will be sufficiently long to warrant their use in this manner. A proper reflector behind the lamp increases the amount of useful light obtained from the lamp.

FIG. 2

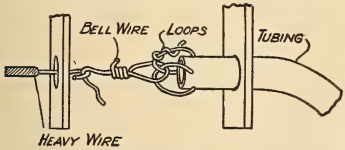
FIG. 3

In ordinary moving picture machines about sixteen pictures are thrown on the screen per second, hence if there are sixteen lamps on the wheel, the latter must revolve once per second. While the arrangement has not yet been adopted, it shows great possibilities. It would decrease bills and add to the comfort of the operator and safety of the audience.

To straighten short wires lay one or two at a time upon a flat board and place another board upon them. Roll the top board back and forth, pressing down upon it.

For the Amateur Wireman

In wiring a house it is frequently necessary to run tubing through two consecutive timbers and sometimes these may be quite a distance apart. It may be easy to get at either side to bore the holes for the tubing, but if a hand hole



METHOD OF DRAWING TUBING THROUGH CONSECUTIVE TIMBERS

is not made, it is impossible to get the tubing started through the second hole. The illustration shows a very simple method by which it may be quickly done without tearing up boards or making unnecessary holes.

Two holes are made through the tubing at right angles to each other and just far enough from the end to prevent pulling out. Now thread a small piece of cleaned bell wire in one pair of holes, then through the other two and splice the two ends, leaving two small loops at right angles. Take another piece of wire of more than sufficient length to reach to the second hole and stick through the two loops. Splice to itself, turning all ends backward so they will not catch on the hole. With the aid of a piece of heavy copper wire with its end cleaned and bent in a hook, the bell wire may readily be caught and pulled through. When the tubing reaches the hole, the small bell wire loops guide it into the hole.

Pliers Made from Fiber

For anyone that is called upon to remove "blown" cartridge fuses from circuits in difficult places, as from the back of switchboards or from any other live circuits where there is no switch to open the circuit while replacing a fuse, I have found a pair of gas pliers made of fiber 5-16 inch thick just the thing. Such a tool is easily made after examining an ordinary pair of pliers, and the two parts may be riveted together with the rivet-holes countersunk and filled with shellac, sealing wax, etc.

The pliers come in handy around all live circuit work and their use in replacing a fuse in a circuit that has a "short" on it may save the owner a pair of burned fingers. ANTON PERTLE.

A Cheap Mellow Light

When the tungsten lamp appeared it was hailed as the beautiful white light. The efficiency of the tungsten lamp is about three times that of the old carbon lamp. In fact, the latest tungsten lamps give us one candlepower with an expenditure of only 1.2 watts, while the carbon lamp produces the same amount of light for an expenditure of over three watts. In order to produce certain æsthetic effects a more yellowish light is sometimes desired. Often there is a desire for a soft mellow light of a color approximating that of the inefficient carbon lamp. It is a mistake to install carbon lamps for this purpose, however, on account of their inefficiency.

Take a tungsten lamp and dip it into a coloring solution of the proper hue. A soft mellow light is thus obtained with an efficiency as high as 1.5 watts per candle. Lamps are easily colored by the use of gelatine. A small amount of gelatine is soaked in cold water, then boiled and strained through a cloth. An analine dye of the desired color is now mixed in water and added to the solution and the lamp is dipped and allowed to cool.

A more satisfactory method is to use a celluloid solution. Take old photographic films and dissolve them in ether and alcohol of equal parts. The coloring solution is then added and the lamp is dipped. This latter method produces a coating which has the advantage of being impervious to water.

SCIENCE EXTRACTS FROM FOREIGN JOURNALS

REFINEMENT OF ELECTRICAL MEASUREMENTS

It would not be thought that a solution of 1-200,000,000th part of any substance in water would give any kind of an effect which could be measured, but even this exceedingly minute quantity was noted by M. Grumbach in some recent experiments which he made at Paris, according to his report to the Academy of Sciences. He made use of bichromate of potash in this case, and in order to detect it in the solution he devised an apparatus somewhat like a battery cell, with a pair of plates dipping in a liquid, but using two separate vessels connected together by a short tube, with a plate in each vessel. Both were filled with acid solution, and the bichromate in very small quantity was added to one vessel. By using a very sensitive instrument to measure the electrical effect, he found that he could still observe an action when the amount of bichromate was not more than above stated. From this it will be seen that our modern methods of measurement are becoming more exact than ever.—*Report of the Académie des Sciences, Paris.*

AGING CHEESE ELECTRICALLY

We have already heard of aging wines by electricity, but the newest idea is the aging of cheese. M. Gokkes of Rotterdam claims to be able to do this, and he takes fresh cheese and applies alternating current to it, using a high voltage of about 10,000 volts. The cheese is put in a receptacle which corresponds to its shape, but it is not tightly enclosed as it is found that the air should act on the cheese at the same time that the current is passing. It takes only a short time, about 24 hours, to carry out the process, and the cheese is said to have all the properties of naturally-aged cheese.—*La Nature, Paris.*

POWER FROM THE OCEAN WAVES

Every now and then we hear of projects for getting electricity from the sea, that is of using the waves so as to operate plants for producing current. There is nothing impossible of course in the idea of using the great force of the waves, and it only remains to find a happy idea for doing this. An Italian officer, Col. Agostino Ravelli, claims to have done this, and his patents are to be put in practice by a Milan company which was formed not long since. The idea is to make some experimental machines on a large enough scale to prove that the plan is a feasible one and then it will not be hard to get capital engaged in the scheme. — *Industrial Italian.*

PROPOSED LONDON POSTAL SUBWAY

An interesting project is the new postal subway for London, and it seems likely that it will be carried out, as an official commission has been looking up the matter and made a favorable report on the question not long ago. The engineers think that a small subway tunnel with trains of cars for carrying only the sacks of mail matter can be run without trouble, and this will take a good part of the mail traffic off the streets, which are already overcrowded. A tube will be laid, six or seven feet in diameter, so as to hold two tracks of two-foot gauge for the small mail cars. These are to be small motor cars built like a subway car in miniature, and will run at 40 miles an hour. But they are to run automatically without needing a motorman. It is claimed that 36,000 mail bags an hour can be transported in this way. Probably a line of some length will be run in the first place in order to try it, and then if all works well the different postoffices throughout the city will be connected in this way.—*Industrie Electrique, Paris.*

NAPLES DEEP RUNNING SUBWAY

Naples is to have a line of electric subway, according to the present plans. It will run across the city and thus bring the different quarters within easy reach of each other. What will make the new subway unique in some places is that it is to run about 500 feet below ground, especially when under the elevated heights of Vomero, overlooking the sea. Electric elevators will be needed in quite a number of the stations in this part of town so as to bring passengers to the surface. Near the city limits, the subway will make connection with the electric line which is now running in the neighborhood of Vesuvius, and at the other end it will be continued by a suburban tramway line which runs for some distance into the country. Laid out on about the same lines as the Paris Metropolitan, the Naples subway will have a double track tunnel, with trains of four cars in general. The cost of the work is estimated at $6,000,000.—*Genie Civil, Paris.*

ELECTRIC CARS OF ALUMINUM

One of the Swiss electric tramway companies is commencing to build its cars of aluminum, at least a good part. One reason for using this metal is that the weight of the car is much lessened and another point is that the painting of the car lasts much longer. It was found that cars built with iron plates soon showed rusting, and the paint suffered much from this. In Zurich, where the new method is being tried, this is an important point, as the cars are painted in a light color. In the first place the metal was used for the roofs of the cars, and the result was so good from the absence of rust that it was decided to go further and to use it for the body covering of the car and part of the flooring. A metal known as dura-aluminum is used here, and it has a small amount of copper added so as to make it harder.—*L' Electricien, Paris.*

CENTRAL STATION POWER IN TIME OF STRIKES

A somewhat curious point about the English coal strike is that it is likely to have a good effect on the electrical industry, and this in an indirect way. Factories in several of the large centers had to shut down for want of coal, but on the other hand the factories which were fitted with electric motors were able to keep on running as usual. This is due to the large coal supplies which the electric stations took care to store up before the strike, so that they had enough coal to keep them running for three months. As a result, it is very likely that the other manufacturers will be led to subscribe for a current supply and this will naturally benefit the central stations and the electrical industry in general.—*Industrie Electrique, Paris.*

WIRELESS FROM AIRSHIPS

Considerable progress is being made in sending wireless messages from airships in Germany. Among the leading workers is F. Eckelmann, chief engineer of the "Albatros" aeronautic establishment, and he is now able to send and receive at distances up to 100 miles. Instead of his first storage battery, which proved to be very heavy, he now uses a small dynamo which is run by the airship motor. It was found that the heavy copper wire of 300 feet length hanging down from the airship caused a bad effect from its swinging, and rocked the airship, so that now he uses an antenna made up of jointed sections of 30 feet each and finds this to be much better. It is hung down from the fore end and has a lead ball fastened below so as to weight it. Using his wireless apparatus, he is able to work with the land stations when flying as high as 2,000 feet and claims that he can go much higher without any trouble. The whole of the wireless outfit is made very light, and does not go above 70 pounds.—*L' Electricien, Paris.*

On Polyphase Subjects

The Dignity of the Wireless

Whatever may have been the status of wireless telegraphy before the Titanic disaster, its place is now clearly and definitely marked. Every ship upon the sea and upon the lakes should be compelled by governmental authority to carry duplicate sets of high efficiency. These should be upon the topmost part of the boat, one forward and one aft, and provided with an adequate storage battery reserve to furnish current to the last. Trained and reliable men—not youths—should be the operators, and at least one of them should be constantly on watch day and night. To these men salaries should be paid commensurate with one of the most important duties on board. The wireless equipment on a ship is no longer to be considered as a convenience to business men and as a means of getting out a chatty newspaper for the entertainment of the passengers. It takes its place at once with the elaborate and costly systems of railroad signaling—a lifesaving proposition.

It is true that hundreds went down with the Titanic. But hundreds were also saved and the wireless deserves the credit. Only by the merest chance could a passing ship have saved the shivering, water-soaked passengers on the lifeboats, before the terrible exposure had made an end of them. Wireless brought the help. Thanks to wireless, the lifeboat must once more be considered a necessity on the great ocean liner, instead of a matter of sentiment assumed by steamship companies, who thought their floating palaces unsinkable.

Another instance, demonstrating the great practical value of wireless telegraphy to maritime interests, recently occurred on the Pacific. On March 23, the S. S. Enterprise sailed from San Francisco, bound for Hilo in the Hawaiian Islands. Two days out, the sudden breaking of the tailshaft, at one o'clock in the morning, rendered the steamer helpless. This happened when she was 300 miles from land, and no ship was in sight, with bad storms prevalent.

The Enterprise is equipped with a Marconi wireless system, and Operator J. B. Taylor immediately began to flash the wireless distress signal, "S. O. S." He soon got a response from the Marconi wireless station in San Francisco.

The president of the steamship company was at once communicated with, and, from the information given him regarding the position of the Enterprise, he knew that the liner Lurline, homeward bound from Hawaii, 300 miles from the Enterprise, could reach her more quickly than a tug sent from San Francisco. Operator Taylor was advised and began calling for the Lurline. He very shortly picked her up, and she immediately started at full speed to the rescue of the distressed steamer. At three o'clock in the afternoon of March 27, the Lurline, proudly leading her captive, safely reached the harbor of San Francisco.

Before the day of the wireless, the accident to the Enterprise would have resulted very seriously. About eleven or twelve days would have elapsed before the non-arrival of the liner attracted attention. Furthermore, a month or two would possibly have gone by before steamers sent in search would be able to locate her. In the meantime, those on board the drifting steamer would suffer severe hardships, while underwriters and

owners, shippers and consignees, as well as the relatives and friends of the missing ones, would be put to much expense and be burdened with extreme worry.

With instances such as these, and that of the "Republic," wireless telegraphy has assumed a position of dignity—of downright necessity—in navigation.

There is fuss and worry and talk about legislation restricting amateur operators —congressional committees, half a dozen pending bills, visiting delegations to Washington and all that. Such legislation is trivial compared with real legislation regarding this broader and far more vital aspect of the wireless question. Legislative bodies of this and other countries should see to it that laws are passed requiring not simply a wireless set on every ship, but one that will work well enough, reach out far enough and be sufficiently well manned to accomplish everything that such a method of signaling and receiving signals can be made to accomplish.

Electric Heating in Swedish Homes

At Gothenburg, Sweden, the coal for household use costs the consumer about $5.22 per ton delivered and firewood sawed and split, delivered and piled in the wood cellar, costs roughly $10.00 per cord, and wood is the fuel most generally used for heating, despite its high cost. Most of the city's population of 170,000 live in apartment houses and tenements and in all these buildings tile stoves designed to burn wood have been built into almost every room.

It is said that the heat that these tile stoves give off is pleasant and the economy of fuel consumption is surprising. They require a minimum of care and attention. A wood fire is started in the morning and allowed to burn down to coals, whereupon all the dampers are tightly closed, confining the heated air and gases to the long winding flues that fill the interior of the stove and bringing the whole to a temperature such that it radiates no small amount of heat. The radiating surface is large, as the stoves usually extend from floor to ceiling and the heat from a single firing is retained for twelve to fifteen hours.

Now that electricity is becoming so cheap in that country owing to the great development of water power, electric heaters are used in these porcelain stoves in order to take advantage of their heat-retaining properties. Portable electric heating elements are inserted in the ordinary combustion chamber and produce during the night sufficient heat to last throughout the following day.

It is stated that the total water power of Sweden is 10,000,000 horsepower for six to nine months of the year, and 2,500,000 horsepower for three months, during the low water period. Of this total 75 per cent is in North Sweden. About 1,000,000 horsepower is now being utilized in Sweden, half of which is hydro-electric power. In some cities the rates range as low as 1.07 to 1.61 cents a kilowatt hour day use and even as low as .54 cent for electric heating current used at night.

The Firefly's "X-Ray" Light

Some recent experiments on the light emitted by a firefly which is found in India seemed to show that the light was of the nature of X-rays. Three of the insects were placed on top of a photographic plate-holder which contained a sensitized plate. Although there was interposed between the insects and the plate the plateholder slide of hard rubber, there was a photographic action on the plate. The action not only showed immediately under the insects, but affected the whole plate. While there may be some error in the experiments, the evidence points to the radiation from fireflies of that species at least as being of a penetrating nature like X-rays. All other experiments seem to show that the radiation from the firefly is no different than ordinary yellow-green light.

Teacher—Who was the first electrician?

Pupil—Noah. He made the arc light on Mount Ararat.

* * *

On one of the most prominent street corners of Victoria, B. C., two Englishmen were deeply engrossed in conversation.

A trolley car had turned the corner, stopped for some passengers to alight, and started off again, when a man turned the corner on the run and boarded the moving car.

The Englishmen looked at each other in amazement.

"My word! Did you see him run?" one remarked.

"The blooming ass!" replied his companion. "I wonder if he didn't know there was another car in 20 minutes."

* * *

Rook—Taylor was always a fortunate man, but doesn't it seem wonderful that his luck should stay with him to the very last?

Raleigh—How was that?

Rook—Why, he was operated on for the removal of a pearl which he had accidentally swallowed while eating oysters, and when the pearl was examined it was found to be valuable enough to pay for both the operation and the funeral.

* * *

A Yankee clinched his heated argument with an Englishman as to the relative size of the Thames and Mississippi by saying:

"Why, look here, mister, there ain't enough water in the whole of the Thames to make a gargle for the mouth of the Mississippi."

* * *

Corporal (to soldier reporting sick)—What's the matter with you?

Tommy—Pain in my abdomen.

Corporal—Abdomen! Abdomen, indeed! You don't 'ave no abdomen; you 'ave a stomick. It's only orficers what 'as abdomens.

* * *

"Here's a nickel," said a thrifty housewife to a tramp at the door. "Now, what are you going to do with it?"

"Well, mum," replied the hungry man, "if I buy a touring car, I sha'n't have enough left to pay my chauffeur; if I purchase a steam yacht, there won't be enough left to defray the cost of manning her; so I guess, mum, I'll get a schooner and handle her myself."

One day in a crowded New York car—mostly all women—a man gave up his seat in due and ancient form, whereat the pretty maiden exclaimed, "You're a jewel." "No, madam," cried the man, "I'm a jeweler. I set jewels." The incident is now famous among the wise in Gotham.

* * *

Standing in the middle of the car tracks at the corner of Broadway and Twenty-ninth street, a much frustrated lady asked the traffic policeman where she could get a car to South Ferry. "Stand still, madam," was the reply.

* * *

Fond Mother—To be quite frank, doctor, the poor girl has been eating her heart out.

Doctor—Ah, that's very imprudent. I'll have to order a change of diet.

* * *

Dugan, the roofer, was sent to a millionaire's palatial home, to try to find a leak in the roof.

As he entered the front hall, the butler whispered to Dugan:

"You are requested to be careful of the hardwood floors as you go upstairs, they've just been polished."

"Sure, there's no danger av me slippin' on thim," Dugan replied. "Oi hov spikes in me shoes."

* * *

An Irishman was called upon to give evidence in a shooting affray.

"Did you see that shot fired?" asked the magistrate.

"No, sor; but I heard it," replied the witness.

"That is not satisfactory. Step down."

As the Irishman turned to go, he laughed, and was rebuked by the magistrate, who told him it was contempt of court.

"Did yez see me laugh?"

"No; but I heard you."

"That is not satisfactory."

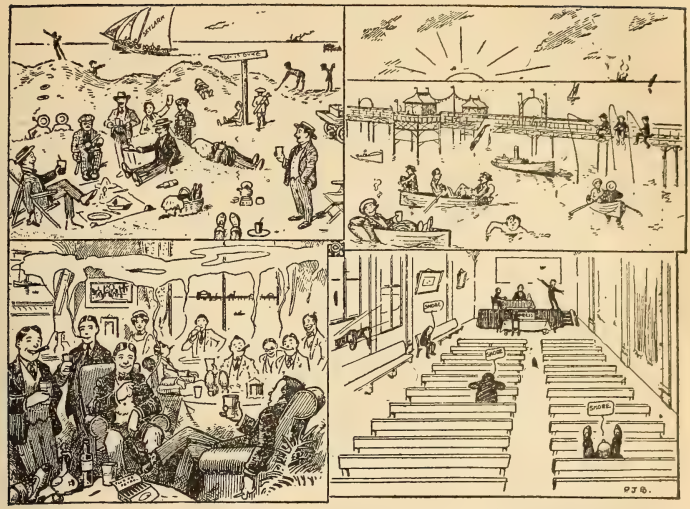
And then the court laughed.

* * *

The teacher had asked the children to write their autobiographies, and the essays were very materialistic.

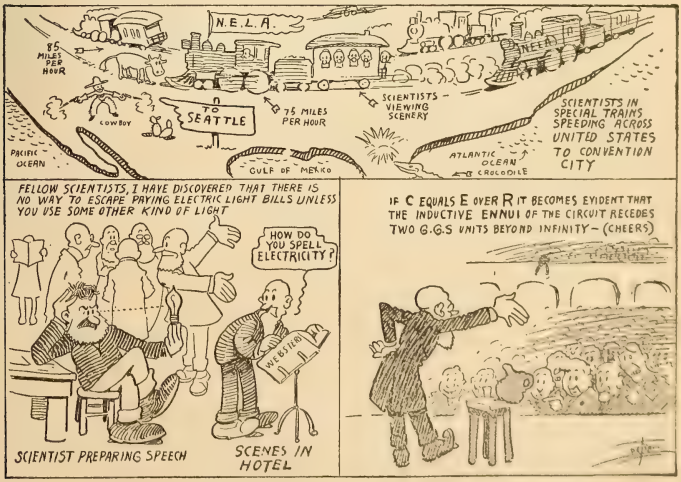
"Now, children," she said, "I don't want you simply to write the happenings of your life; write what you really feel inside."

Little Willie, in his second attempt, wrote: "Inside I feel a heart, liver, lungs and stomach, and inside the stomach I feel an apple, a corn ball, a pickle and a glass of milk."



From Electrical Industries, London

Above is a London cartoonist's idea of an electrical convention and below is our cartoonist's conception. Neither one claims ever to have been at an electrical convention.



Common Electrical Terms Defined

In this age of electricity everyone should be versed in its phraseology. By studying this page from month to month a working knowledge of the most commonly employed electrical terms may be obtained.

PARAFFINE.—A wax used in condensers and other electrical apparatus as an insulator. It is made by distillation from cannel coal, coal tar, or petroleum.

PEAK OF LOAD.—The greatest load an electric power plant is called upon to carry during any given period.

PENDANT PULL SWITCH.—A switch usually installed in a fixture or upon the ceiling and operated by successive pulls of a cord.

PERMANENT MAGNET.—A bar of steel which has been magnetized and which retains its magnetism after the magnetizing force has been removed.

PERMEABILITY.—A term applied to the ease with which a magnetizing force such as a magnet or a coil of wire carrying current can impart magnetism to another material or body, which accordingly is said to be more or less permeable.

PERMEAMETER.—An apparatus invented by Silvanus P. Thompson for roughly measuring permeability.

PHASE.—In alternating current the electromotive force and current each pass many times a second from a zero value (O_1) to maximum (+), then back to zero (O_2), then to the negative maximum value (—) and thence back to zero (O_3), as shown by the diagram. This complete set of values is called a cycle and the time taken to complete a cycle is a period. When a cycle is taken as a unit, the phase is the portion of the cycle completed, as expressed by the time elapsed of the part of a cycle completed, divided by the total time of the cycle or a period. Thus assuming any given point in these changing values, as (O_1), the illustration shows the portions of a period which may be designated as ¼ phase, ½ phase, ¾ phase, etc.

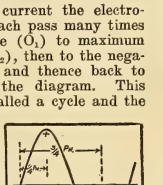


Diagram of an Alternating Current Wave

PHASE DETECTOR.—An instrument for determining when two alternators running in parallel are producing currents of the same phase.

PHOTOMETER.—An apparatus for finding the intensity of light given by a luminous source.

PILOT LAMP.—An incandescent lamp connected to the circuit of a dynamo so as to show the building up of the voltage by its brightness when the machine is started.

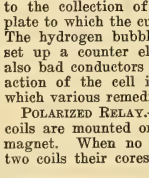
PLATE CONDENSER.—A condenser in which glass upon which tinfoil is pasted is used.

PLATING BATH.—The solution from which by electricity metal is taken and deposited upon articles suspended in it. (See Electroplating.)

PLUNGER.—A movable iron rod or bundle of soft iron wires within a solenoid or coil of wire. When current is passed through the wire the plunger is drawn into the coil.

POLARIZATION.—When a cell or battery of cells is connected to produce current it is found that the strength of the current falls off after a few minutes and may even stop. This effect is due to the collection of hydrogen bubbles on the plate to which the current is flowing in the cell. The hydrogen bubbles are electro-positive and set up a counter electromotive force and are also bad conductors and offer resistance. This action of the cell is termed polarization, for which various remedies are applied.

POLARIZED RELAY.—A relay in which the two coils are mounted on one pole of a permanent magnet. When no current flows through the two coils their cores have the same polarity as the pole of the magnet to which they are attached. The tongue between has an opposite polarity and is attracted to one or the other of the coil cores. If a current is passed through the coils their cores immediately become of opposite polarity and the tongue is repelled by one core and attracted by the other. If now a current be sent through the coils in the opposite direction the tongue flies to the other side. A properly made polarized relay is highly sensitive. (See cut.)



Polarized Relay

POLE PIECES.—The extension of the cores of the magnets of a dynamo, motor or other device depending upon the lines of force from the pole extensions for operation. Pole pieces are so shaped as to give proper distribution of the lines of force.

POLE TIPS.—The extreme ends of the pole pieces of a field magnet.

POROUS CUP.—A cup of unglazed earthenware used in voltaic cells to separate two liquids and yet allow action. The Daniell and the Grove cells are examples of this type of cell.

POSITIVE ELECTRICITY.—An arbitrary name applied to the kind of electricity with which a piece of glass is charged when rubbed with silk.

POSITIVE PLATE.—In a voltaic cell having a zinc and copper plate it is the zinc plate. The plate from which current flows in the cell.

Popular Electricity
In Plain English
Henry Walter Young, Editor

Vol. V | July, 1912 | No. 3

CONTENTS

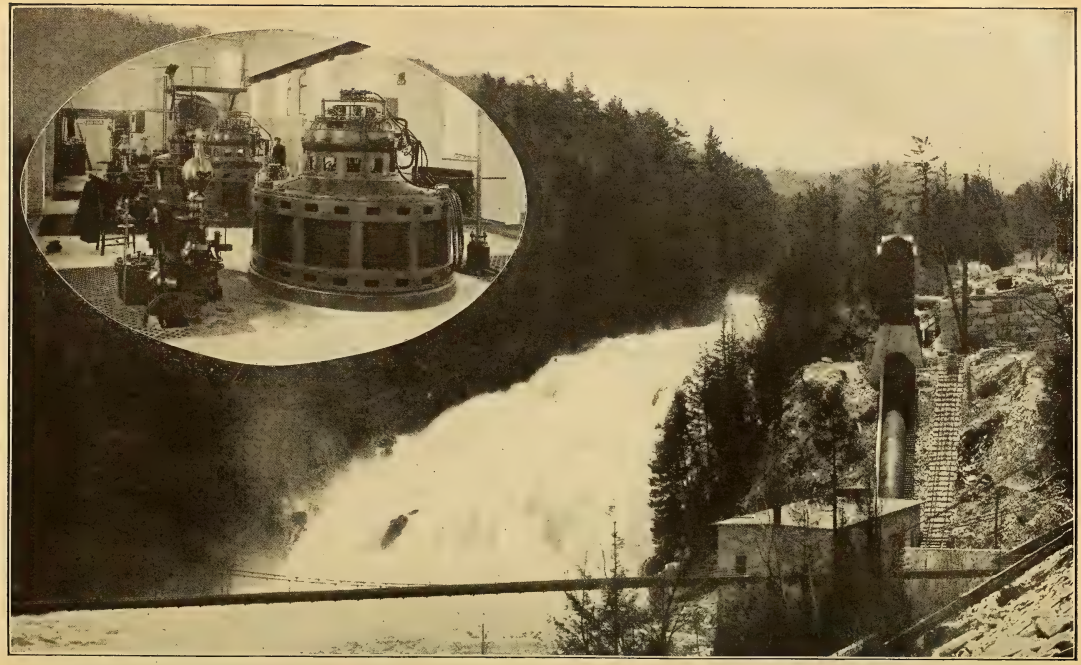
	Page
An Ancient Industry Electrified. By Orin Edson Crocker	209
A Paris Duelling School	211
What the Wireless Told. By Frank Parker Stockbridge	212
Surprising the Barbarians of Formosa	218
Speed Maniac New Menace to Trucks	219
The Manojlovac Plant in Austria Hungary	220
Some Secrets of Electrical Stagecraft. By T. J. Newlin	221
Electric Signal for Life Savers	226
Hydro-Electric Wonders in California. By Archie Rice	227
The Wireless	232
The Romance of Wireless. By Edward Lyell Fox	233
An Odd Pile Driver	236
Electrical Securities. By "Contango"	237
Picture Sending by Wire	240
An Electrical Genius Released from Prison	241
Electric Clocks in Electric Tramcars	241
Ambition. By Winder Elwell Goldborough, M. E.	242
Deciphering Manuscripts with Ultraviolet Rays	243
Signal Lamp on Gloves	244
Electric Refuse Wagons of Paris	244
A "Boiling" Battery	244
Trolley Wires for Airship	245
Collecting Static Electricity from the Air	245
First Money Earned from Telephone	245
Electric Chickens	246
First Foreign Language Over Telephone	246
Tower Lights at Girard College	247
Observation Tender for Submarines	248
Electric Photography	249
Telephones in Tripoli	249
The Perfected Money Laundering Machines	250
Gray Squirrels Gnaw Cables	251
Pottery Designs for Lamp Bases	251
Remodeling Fire Engines for Electric Propulsion	252
Safeguarding the Lives of Little Children	253
Aerial Trams of a Utah Mine	254
Demonstrating a Good Cigar	255
Phonograph with Electric Brake	255
The Arrival of the Chauffeuse	256
Smelting Tin at Cornwall	256
Lighting Effects Past and Present	257
German Sidewalk Signs	257
Headlights for Victims of Night Shipwrecks	258
Immense Electrification Project for Berlin	258
The Carving of Stone Tablets	259
Apparatus for Breaking in Shoes	259
The Cameragraph	260
Trinity's Electric Sign	261
Electric Parade for the Shriners	262
Germany's Long Distance Wireless Operations	262
Electricity in Embroidery Designing	263
Longest Nickel Street Car Ride	263
Promptness of American and English Telephone Operators Compared	264
X-rays in Testing Precious Stones	264
Portable Safety Electric Lantern	264
A Swiss Coffee Mill	265
Three Wheeled Electric Delivery Wagon	265
Treadle Controls the Motor	265
Fire and Burglar Alarm Switch	266
A "Polychrome" Lamp	266
An Approved Lamp Cord Adjuster	266
Jeweler's Power Motor	267
A Handy Contractor's Hoist	267
Reminder Clock	267
Smallest Electric Runabout	268
Electric Pencil Holder	268
Return Call Button Hides Call Bell	268
Long Cord Turn Down Lamp	268
Electrical Men of the Times. Samuel Groenendyke McMeen	269
Modern House with Vacuum Cleaner	270
Service Kitchen Cabinet	271
Observations at a Household Show	272
Color Scheme Cookery	274
Illumination of Works of Art	275
What the Motorist Shall Wear	276
The Tragedy of Wash Day	277
Electric Boiler and Turbine Wheel	278
A Miniature Pleasure Park	279
The Luminous Goblet	280
Learning the Telegraph Code	280
An Odd Telegraph Set	281
To Make a Small Magneto	281
Experimenting with Large Induction Coils	282
Flashlight for Signaling	282
Wireless Outfits for Small Boats. By Richard H. Foster	283
Capacity of Condensers	285
Regulation of Amateur Radio Operation. By Eugene Peterson	286
Questions and Answers in Wireless. By A. B. Cole	287
Wireless Club Directory	287
Fishing Wire and Its Manipulation	290
Water Pressure Signal	291
Adjustable Water Rheostat	291
A New Electric Furnace	292
Brine Saving Device	292
Emergency Torch for Electricians	293
Apparatus for Demagnetizing a Watch	293
A Gas Fire Packing	294
Fans for Sealing Room	294
Wiring System for Electric Irons	294
An Electric Water Heater	294
A Simple Photometer	295
Illuminating the Steam Gauge	295
Homemade Cash Drawer Alarm	295
Ferris Wheel to Display Goods	296
A Game Motion Display Rack	296
Attracting the Isaac Waltons	296
Auto Rotor	297
Light Fixtures on Bed	297
The Flying Fountain Pen	297
Revolving Turntable for Window	297
Marconi Contract with British Government	298
Increasing Simplon Tunnel Traffic	298
Artificial Rubber	298
Electricity from Household Waste	299
A New Electric Furnace	299
Deadening the Hum of Live Wires	299
Testing Wine with a Telephone	299
Electric Current from Sunlight	299
New Books	300
All-British Cable to Canada	301
Foot Amputated by Wireless Instructions	301
Coating Metals with Lead	301
Short Circuits	302
Common Electrical Terms Defined	304

RENEWALS When your subscription expires, you will find a renewal blank enclosed here. You should fill out and return with remittance at once to avoid missing a number. Positively no copies will be mailed on any subscription after same expires unless renewed, and we cannot agree to begin subscriptions with back numbers. The date on wrapper of your magazine shows issue with which your subscription ends. The extension on this date to period covered by renewal is sufficient receipt. If any other is desired it should be requested at time of renewal.

CHANGE OF ADDRESS Notify us promptly of any change in your address, giving both the old and new location. Since our mailing list for each issue closes the 5th of the preceding month (i. e., list for February closes January 5th), changes received after the 5th must necessarily take effect with issue for second month following. Postmaster as well as Publisher should always be notified of changes in order to forward mail sent to old address.

ISSUED MONTHLY BY POPULAR ELECTRICITY PUBLISHING CO., Commercial Bldg., Chicago, Ill.
YEARLY SUBSCRIPTION, $1.50; CANADIAN, $1.85; FOREIGN, $2.25; SINGLE COPY, 15 CENTS
No additional copies will be sent after expiration of subscription except upon renewal.
Entered as Second Class Matter April 14, 1908, at the Post Office at Chicago. Under Act of March 3, 1879.

Copyright 1912, by Popular Electricity Publishing Co.



SUTHERLAND FALLS NEAR THE VILLAGE OF PROCTOR, VT., WHICH FURNISHES ELECTRICITY FOR THE WORKING OF MARBLE QUARRIES

Popular Electricity
In Plain English

VOL. V JULY, 1912 No. 3

An Ancient Industry Electrified

By ORIN EDSON CROOKER

The quarrying of marble for building purposes is one of the oldest industries in the world, dating back to the time of Solomon's temple and probably earlier. The Parthenon, the Hippodrome and other edifices of ancient Athens were also built of marble, the quarrying of which was conducted on a large scale by the Greeks over two thousand years before the time of Christ.

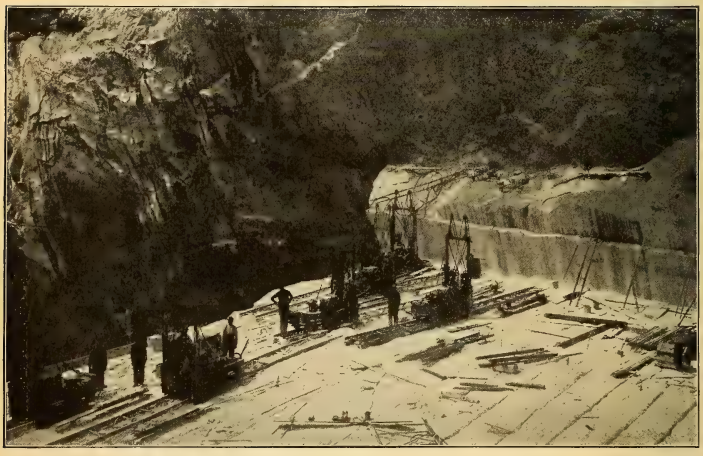
It is a curious fact that while some of the methods used today in the production of marble are identical in principle with those in use so long ago, it has remained for the application of electricity to bring this ancient industry to its great modern productiveness. For instance, the earliest known methods of sawing marble were practically the same as those in use today. Sand, running water, and a "saw" made of soft iron and without teeth are still used to cut marble into slabs and blocks. Electricity now supplies the power which in olden times came from toiling human

OPERATING AN ELECTRIC DRILL IN A MARBLE QUARRY

beings. This is the only difference. In the large quarries of western Vermont, the recognized center of the industry in this country, no other power is used in the many processes to which the stone is subjected. It is quarried, cut into desired sizes, polished and finished—all by electricity.

Nature seemed to anticipate the future needs of man when she prepared long ages ago for the Twentieth Century marble industry of Vermont. Not only did she deposit beneath the green hills of the western part of the state seemingly inexhaustible stores of this valuable stone, but she fashioned the water courses so that in later time man could generate close at hand the power needed in its quarrying. Sutherland Falls, in the little village of Proctor—scarcely a stone's throw from the great mills where a surprisingly large proportion of the marble used in this country is finished, has always been a delight to look upon. Its tumbling waters are now more than beautiful; they have become commercially useful. An electric hydraulic power house converts them into power that is used not only in Proctor, but at West Rutland, Brandon, Florence and other points. This plant, which is one of two that are run together in a common transmission line, is made up of three units, each consisting of a 1,200 horsepower turbine connected to a 750 kilowatt generator.

The quarrying of marble is an interesting process. The first step is that of cutting the stone into large rectangular blocks and freeing them from their position in the quarry bed. Years ago in Vermont the stone was quarried by hand, as is the case in some parts of Italy and Greece today. But this method was too slow for practical use and an inventive genius gave the world the stone channeling machine, by means of which a single skilled operator is able to do the work in a single day that formerly required from 50 to 100 men. These channeling machines, which are operated by electricity, run back and forth on rails, and the drills with which they are equipped are driven with powerful force downward into the stone, cutting a slit about an inch wide and to any desired depth up to ten feet.



CHANNELING MACHINES AT WORK IN A MARBLE QUARRY

It is slow work, depending somewhat on the grade of marble. Ordinarily a cut 20 feet long and eight feet deep will require from 20 to 24 hours of constant work.

When the narrow perpendicular cut has been made to the required depth, steel drills, also driven by electricity, are used to bore in from the side in a horizontal direction. Holes are made from four to six inches apart and along this line the marble is detached from its bed by means of wedges. The block thus loosened is raised to the surface by means of powerful electric derricks, after which it goes to the mill to be sawed into slabs or blocks.

In this operation the rough block of marble is placed in position under a set of "saws" made of soft iron. A stream of water carrying sand in suspension plays over the block of stone as the saws are moved back and forth by means of electrically operated machinery. The edges of the sharp sand cut into the soft marble as the strip of iron grinds them back and forth against the stone. Here, again, time is required to accomplish results, sometimes from 20 to 30 hours being needed to cut through a block of marble five or six feet thick.

From the sawing mill the slabs and blocks go to the polishing sheds, where huge electric buffers complete the work by giving the stone a beautiful polish, and making what has hitherto been a rather unattractive piece of greyish white stone a glistening, shining slab of finished marble—a thing of beauty and probably designed to fill a useful place in some building already under construction.

A PARIS DUELLING SCHOOL

While in many countries the practice of duelling is discouraged, it still lives in Paris. It is not uncommon to read in the papers notices of a duel to take place within the next few days. The duellists have at their disposal a very convenient academy for practice, equipped with all modern comforts. This shooting gallery is specially equipped for instructing and the practice of duellists. The targets are so-called electric silhouettes, representing human figures in life size, the figures being divided into seven fields. Every shot which reaches the mark is signalled to the marksman by an electric annunciator, while a fac-simile of the target placed near him enables him to see where his bullet has struck. The range is 50 to 80 feet.

THE MARKSMAN PROCEEDS AS HE WOULD IN A REAL DUEL

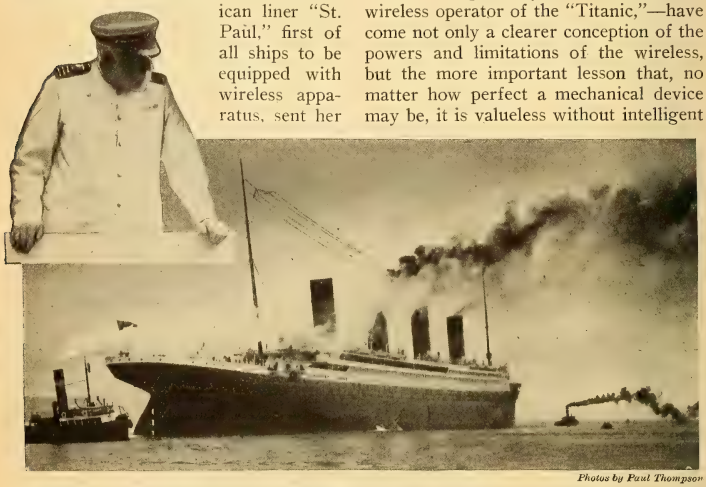
The marksman proceeds as he would in a real duel, the loader commanding: "Attention." "Fire—one, two, three." At the word fire the marksman raises his pistol and at the word three, he is required to fire.

Perhaps, as civilization proceeds, the mere hitting of the silhouette will give the Parisian duelist sufficient "satisfaction" for wounded feelings.

What the Wireless Told

By FRANK PARKER STOCKBRIDGE

The disaster to the "Titanic," hugest of all steamships, which, on her maiden voyage, struck an iceberg in the North Atlantic and sank in two miles of water with the loss of 1,595 of her passengers and crew, put wireless telegraphy to the severest test it has had since the American liner "St. Paul," first of all ships to be equipped with wireless apparatus, sent her first message shoreward on Nov. 15, 1899.



Photos by Paul Thompson

THE TITANIC STARTING OUT FROM SOUTHAMPTON ON HER MAIDEN VOYAGE. ABOVE IS CAPTAIN E. J. SMITH

The attention of the whole world was focused on Signor Marconi's invention for four breathless days, while the details of the loss of the giantess of the seas percolated shoreward through space. And out of the mass of contradictory and false reports that at first buoyed up the hopes of two continents; the criticism and complaints levelled at many of those responsible for the operation of the wireless and the praise of the hero who died at his post—"Jack" Phillips, chief wireless operator of the "Titanic,"—have come not only a clearer conception of the powers and limitations of the wireless, but the more important lesson that, no matter how perfect a mechanical device may be, it is valueless without intelligent and resourceful men to operate it. The wireless did not fail to do all that was asked of it. The tremendous loss of life was due to human errors, and it is fair to add that the saving of 745 of the Titanic's company was due to human brav-

ery, which would have been, in all probability, futile had not the wireless done its share.

I had the privilege of discussing the Titanic disaster in all its phases with Signor Marconi himself, on the eve of his return to Europe after giving his testimony before the Senate investigating committee, and his conclusions as well as my own are embodied in this attempt to bring together, for the first time, a complete and consecutive statement of the part the wireless played in this greatest of all ocean tragedies.

Copyright by Paul Thompson

MR. MARCONI AS HE APPEARED BEFORE THE SENATE COMMITTEE

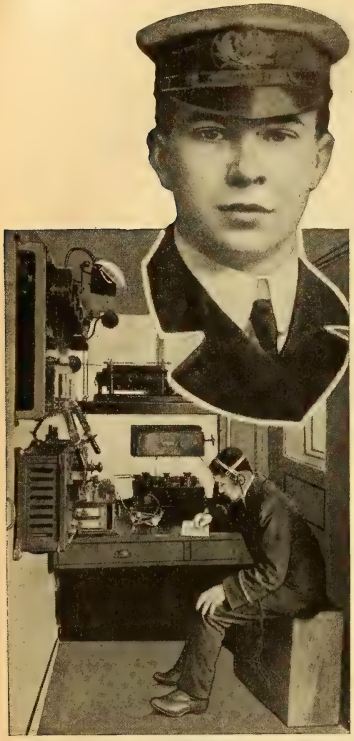
It is perfectly clear that had the captain of the Titantic paid attention to the wireless warnings of ice, which the Californian and other ships sent him during the twelve hours preceding the wreck, no lives would have been lost. That he proceeded at a speed of 21 knots an hour into the very region where huge bergs were reported, and continued this speed long after dark, was a human error that the wireless could not avert. Without wireless less blame could attach to the captain who risked his ship amid the ice.

After the collision occurred, although the wireless did all it was called upon to do, it was only by accident that any ship near enough to be of assistance heard the Titanic's "C. Q. D.," and only by accident that other ships, nearer still than the rescuing Carpathia, either did not hear the call or were unable to render succor. And back of the whole tragedy lies a human error that not all the wireless equipment in the world could have overcome—the failure to provide boats enough to save all on board.

It was 10:30 o'clock on Sunday night, April 14, 1912, when Harold Thomas Cottam, wireless operator on the Carpathia, caught the message in "Continental Code" which I have quoted at the head of this article. That he caught it was due only to the accident that, long after he was officially off duty, he was listening at his receivers in the hope of picking up some news about the English coal strike. Indeed, he had already begun to undress, with the receiving instruments still on his head, when Phillips' distress call, winding up with "O. M."—the half jocular, half affectionate sea slang for "old man"—reached him. How Captain Rostron, of the Carpathia, turned his vessel from its course and picked up the Titantic's survivors at sunrise is a story that will live long in the annals of the sea as an example of prompt and courageous obedience to the call of humanity.

But there were other ships—many of them—within range, and some of them nearer than the Carpathia. Accident and human error prevented these from being of service. The Californian, her engines stopped because of the captain's cautious desire to avoid the dangers of night navigation through the ice, could have been alongside the Titanic before the latter sank—if she had carried two operators, so that one should always be on duty. Even with her engines stopped and her sending apparatus out of commission, with a wireless operator on duty at the receiving instruments she might have learned of the wreck before it was too late. The Mount Temple, her wireless in full commission, was still nearer. Her response to the Titanic's call was instantaneous, but when within only a few miles of the sinking leviathan she found

herself hemmed in by ice and unable to make further headway. Within wireless range also were the Allan liners Parisian,



Photos by Paul Thompson and Brown Bros.

OPERATOR JACK PHILLIPS, WHO WENT DOWN WITH THE TITANIC, AND A SCENE IN THE TITANIC WIRELESS ROOM

Virginian and Tunisian, the German freighter Frankfurt, the Russian steamship Birma and the great Olympic, twin sister of the Titanic. All of these heard the Titanic's call, and all responded, but with every ounce of steam their boilers could put into their engines, they could not cover the hundreds of sea miles in time to be of service. And closer than any other ship—so close that it could have saved all on board—was a tramp freighter which, having no wireless equipment whatever, proceeded on its course all unconscious of the tragedy being enacted so close at hand.

How the wireless men on the Titanic sent out the call for help has been told by Harold Bride, second operator, who stuck to the ship until she sank and was saved when Phillips, the chief operator, lost his life. Awakening in the night he heard Phillips sending routine messages to Cape Race. With no thought but to help out his friend, he dressed and entered the operating room just as Captain Smith came in.

"We've struck an iceberg and you'd better be ready to send out a call for assistance," said the captain. "Wait until I find out how much damage has been done before you send it." So the routine work was continued, the wireless working perfectly in the crisp, cold, calm and star-lit night. In a few minutes the captain returned and ordered the call for help sent out.

"What call shall I send?" asked Phillips.

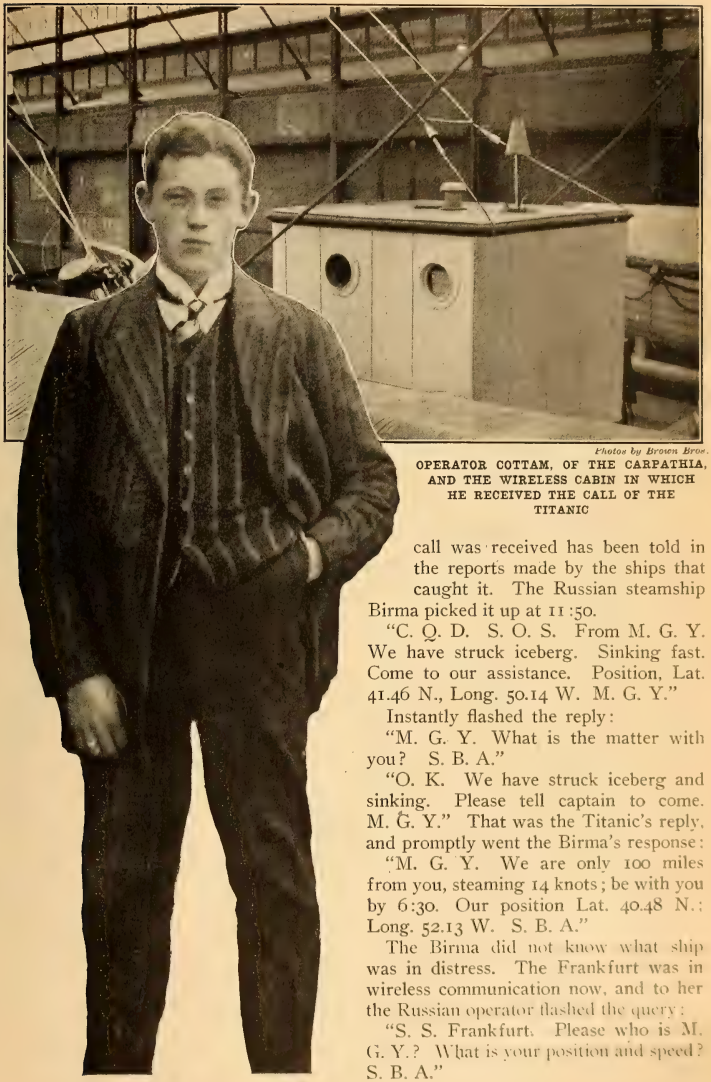
"The regulation international call for help," was the reply, and Phillips began to send out "C. Q. D."—the call to which every ship is bound to listen and respond. "C. Q." is a signal to all stations to stop sending and listen. Alone it is important but not alarming. But when followed by "D"—the signal of distress—it means "hurry to our aid."

"What are you sending?" asked Captain Smith, returning again to the wireless cabin.

"C. Q. D." replied Phillips.

The situation was still a joke to the wireless men, firm in their belief that the new ship was unsinkable, and even to the captain himself, for he also laughed when Bride remarked: "Send 'S. O. S.' It's the new signal, and it may be your last chance to send it." So Phillips interspersed his "C. Q. D." with the "S. O. S." call.

All the wireless records of the Titanic sank with her, but the story of how the



Photos by Brown Bros.

OPERATOR COTTAM, OF THE CARPATHIA, AND THE WIRELESS CABIN IN WHICH HE RECEIVED THE CALL OF THE TITANIC

call was received has been told in the reports made by the ships that caught it. The Russian steamship Birma picked it up at 11:50.

"C. Q. D. S. O. S. From M. G. Y. We have struck iceberg. Sinking fast. Come to our assistance. Position, Lat. 41.46 N., Long. 50.14 W. M. G. Y."

Instantly flashed the reply:

"M. G. Y. What is the matter with you? S. B. A."

"O. K. We have struck iceberg and sinking. Please tell captain to come. M. G. Y." That was the Titanic's reply, and promptly went the Birma's response:

"M. G. Y. We are only 100 miles from you, steaming 14 knots; be with you by 6:30. Our position Lat. 40.48 N.; Long. 52.13 W. S. B. A."

The Birma did not know what ship was in distress. The Frankfurt was in wireless communication now, and to her the Russian operator flashed the query:

"S. S. Frankfurt. Please who is M. G. Y.? What is your position and speed? S. B. A."

Back flashed the startling answer:

"S. B. A. Position Lat. 49.47 N.; Long. 40.10 W. M. G. Y. is the new White Star liner Titanic. Titanic O. M.! D. F. T."

As the Frankfurt's message stopped, the agonized call for aid again clicked out in the ears of the Birma's operator:

"S. O. S. S. O. S. C. Q. D. C. Q. D. M. G. Y. We are sinking fast; passengers being put into boats. M. G. Y."

And again—last call of all to reach the Russian ship:

"C. Q. M. G. Y. Women and children in boats. Cannot last much longer. M. G. Y."

Ship after ship was catching the distress signal, responding with words of hope and cramming on speed to try to render aid.

4 a. m.—Californian now working with Virginian.

4:25 a. m.—Californian now working with Birma.

5:10 a. m.—Signaled Californian. She wants my position. We are very close together.

6 a. m.—Much jamming in wireless instrument.

6:45 a. m.—Carpathia reports twenty boatloads rescued from Titanic.

7:30 a. m.—Baltic sends service message to Californian as follows: "Stand by. You've been instructed to do so frequently." This signaled by an inspector.

7:40 a. m.—Californian gets message of no need to stand by, as nothing more could be done. Carpathia and Olympic very busy.

Only two of the ships involved in the affair were equipped with the most modern wireless apparatus—the Titanic itself and the Olympic. Each carried a five kilowatt set, with an auxiliary gasoline engine to run the dynamo in case of a breakdown of the regular engine that operated the lighting circuit. It was not necessary to use this, however, as the lights did not go out until the ship was actually plunging beneath the waves. Only the Olympic was able to get a message to shore in the hours immediately following the sinking of the Titanic without relaying it through other ships, and all that the world knew of the disaster until Monday evening was contained in the report from Cape Race, where the Marconi station had caught the Titanic's first "C. Q. D." calls. Cape Race had communicated with the Virginian and sent that ship on its way toward the Titanic, and the Baltic and Olympic reported themselves as being on the way to render aid. But so strong was the belief that the Titanic simply could not sink that all the civilized world was shocked when, at 6:30 o'clock on Monday evening, the Olympic succeeded in getting to shore the fateful message from the Carpathia telling of the fearful catastrophe:

"Carpathia reached Titanic's position at daybreak. Found boats and wreckage only. Titanic sank about 2:20 a. m. in 41.46 North, 50.14 West. All her boats accounted for, containing about 675 souls saved, crew and passengers included. Nearly all saved women and children. Leyland liner Californian remained and searching exact position of disaster. Loss likely total 1,800 souls."

What made the shock the worse was that the public had been lulled into a false sense of security by the publication in the afternoon papers, in apparent good faith, of messages calculated to relieve all anxiety. The air had literally been full of wireless messages all day Monday, and out of the fragments someone had picked up and wired from Halifax to the press the message, "All Titanic passengers safe. Towing to Halifax." This became expanded during the day into a detailed account of the towing of the Titanic by the Virginian and Parisian—two ships that had been in communication with the shore and were known to have been heading for the wrecked vessel. But there is reason to believe that there was no intent to deceive on the part of the author of this alleged dispatch, for Captain Haddock of the Olympic received during Monday a wireless inquiry: "Are all Titanic passengers safe?" which he at first read without the

inquiring "are" and posted on the ship's bulletin board, and a little later the wireless men on the Olympic caught a message from the Asian telling of towing an oil tank to Halifax. It is entirely probable that some amateur caught fragments of these two messages and pieced them together to make the misleading report which was circulated on April 15th.

How Cottam on the Carpathia, aided by Bride, the surviving Titanic operator, who worked the wireless for two days in spite of frozen feet and other injuries, sent the long list of names of survivors and personal messages from them to their friends ashore, relaying through two and sometimes three other ships, and working almost without sleep until the Carpathia reached the port of New York, is a familiar story. How they refused—much to the indignation of some newspapers—to pay any attention to inquiries for details of the wreck while they had this mass of business in front of them is also familiar. "You couldn't expect them to turn themselves into reporters," said Signor Marconi, when I mentioned this phase of the matter to him. "The captain had sent his report of the wreck. The next business was, of course, the important news of the names of those saved, then their personal messages to their friends. If there had been a reporter on board he could have filed a report to his paper, but it would have had to be held up until these other matters were out of the way." He also refused to indorse the criticism of Bride and Cottam for failing to send more than a curt "No" to the U. S. scout cruiser Chester's inquiry as to whether Major Archibald Butt, President Taft's aide, was among the saved, or for selling the stories of their personal experiences—not reports of the wreck of the Titanic—to a newspaper.

"On the whole, you have reason for pride," I suggested to the inventor of the wireless.

"I am proud," replied Signor Marconi. "It is worth while to have lived, to have made it possible for these people to have been saved. But I see many things that will have to be done if wireless is to be of the fullest utility. I think it will be necessary to compel all ships to carry two operators, so that one may be on duty at all times. Some of the ships failed to get the Titanic's call for help because they were receiving the news report from Cape Cod. With two operators, one could be working the news report, the other—on any ship equipped properly—could be listening for distress signals, which would not interfere with the long distance news messages."

This inability of the long distance instruments to pick up ship messages unless especially tuned to them was illustrated, by the way, by the fact that as late as Saturday, April 20, the wireless men receiving trans-Atlantic messages at Glace Bay had not heard the details of the Titanic affairs.

Mr. Marconi also pointed out the necessity for governmental control and regulation of amateur wireless experimenters, as is done in England. This could be done, he said, without imposing onerous conditions, as amateurs could be permitted to operate freely at certain specified wave lengths which are not used for commercial or marine purposes. A beginning toward closer coöperation between the commercial wireless establishments and the United States government was made when, at the suggestion of the Marconi company, the Navy Department instructed all of its naval stations and ships to cease sending while the names of the Titanic survivors were coming in, and the company itself suspended all business except between the Carpathia and the stations at South Wellfleet, Siasconset, Sagaponack and Sea Gate, which are unaffected by amateur interference.

Out of the Titanic disaster is bound to come, at any rate, a more general use of wireless, better equipment for ships and consequently greater safety at sea—but the wireless will never be able to prevent captains from running their ships into the ice, nor can it take the place of boats.

"The Japanese have always had a predilection for electricity," said Dr. Nitobe, a professor of the University of Tokio, while visiting Washington recently. "I recall a striking instance of their application of it more than fifteen years ago that was as unique as it was effective.

"In the early '90's the Japanese defeated the Chinese in war and in the indemnity, the Japanese acquired the large island of Formosa, lying off the coast of China.

"Now while the lower part of Formosa is very fertile, and grows the finest of tea and rice, being civilized as well, the upper portion, indeed by far the larger part of the island, was overrun by the bloodthirstiest of savages, who considered murder and robbery as the only genteel professions. They had been accustomed, under Chinese rule, which was no rule at all, to make descents upon the few peaceful farmers in the lower end about the time their crops were ripe, and, after killing enough of them to satisfy their lust for blood, carry away to their mountain wildernesses enough rice and tea to last them until time for another incursion.

"When the Japanese took possession and saw the state of affairs, they sent a strong military force to Formosa and drove these savage barbarians far up into the northern end of the island. Then they brought in a host of immigrants from Japan who speedily cleared the wilderness, which was dripping with fertility, and planted their crops—but not before the Japanese authorities had stretched across the island, 300 miles from ocean to ocean, along the line between them and the savages, a simple wire fence; that was all. There was a barbed wire on top and a barbed wire on the bottom, and right between ran an innocent looking smooth wire of the telephone type.

"Pretty soon the savage natives, having found that the Japanese soldiers had gone, started to make one of their customary raids upon the crops lying so temptingly beyond the fence. They got together with their war clubs and other such grisly weapons and, starting on their bloody excursion, reached the harmless looking fence and commenced to clamber through—when the Japanese engineers who manned the powerful electric generators connected to that particular section of the fence, turned on several thousand, or million volts it was, maybe, along that innocent middle wire. That was all, but it was enough; as soon as a painted chief took hold of it to get through he dropped like a log, and so did those who tried to follow him. I am told that our people at the electric plants never stirred when they heard the wild

shrieks that arose, but merely shovelled in more coal and turned on more 'juice,' I believe you call it. The next day when a party went up to investigate they found the savages strung along the fence like so many dead cattle.

"The natives made one or two attempts, further, with like results. Then when they found they were starving, as well as cursed by some powerful God within the magic wire, they came in and, laying down their arms, abjectly surrendered. They say they make the best farm hands in Formosa now—but they've never comprehended the mystery of the middle wire."

SPEED MANIAC NEW MENACE TO TRUCKS

That distinctly revolutionary type of hilarious individual known as the speed maniac, who became particularly progressive with the advent of the automobile, now looms up as a special menace to the motor truck industry.

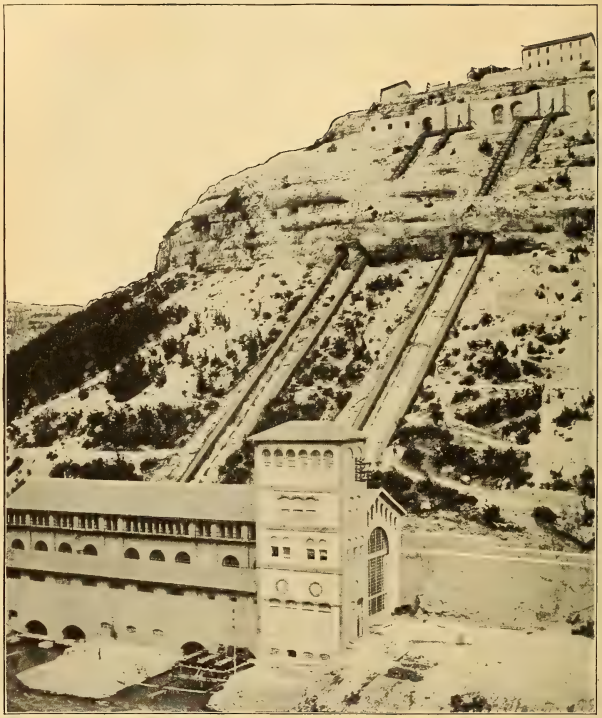
Experts interested in the commercial vehicle because of its economic possibilities, declare that the driver who throws reason to the wind in the operation of a truck and hits up too fast a pace, is unquestionably the most expensive features connected with motor truck maintenance.

Tire manufacturers, in particular, attack the speed maniac and his methods. They argue that speeding is by all odds the most expensive of all the deteriorating influences to which tires are subjected.

A tire manufacturer recently said: "It makes no difference how well solid tires are made, or to what extremes the manufacturer goes to fortify them against the incessant knocks of road travel, they will not withstand the abuses of the speed maniac. Speeding is an evil that can result in but one thing—decreased tire mileage and increased tire expense. And the particularly aggravating feature of this is that it is a matter that cannot be regulated unless a driver obeys instructions and sends the truck along at a moderate pace. Reliable drivers do this, but there is always the other fellow who, as soon as he is out of sight of the boss, throws open the throttle and burns up the pavement. Such a man is decidedly expensive to the truck owner.

"Demonstration has proved that at an average speed of twelve miles an hour the life of a tire is about twice what it is at an average speed of 20 miles an hour. Still higher speeds reduce the life of the tire proportionately. Therefore, it should not require any great amount of meditation to determine the effect of constant speeding upon an owner's tire bills."

The only way to clip the wings of the speed maniac is to furnish him with a truck that is geared for low or moderate speed and in which the power is limited, that is to say, furnish him with an electric truck. As an economic feature in the transportation of goods, the electric truck would long ago have secured the dominating position, but for the foolish notion some have derived from the gas car craze that high speed and power are essential to the moving of goods.



THE MANOJLOVAC PLANT IN AUSTRIA-HUNGARY

On the Kerka River in Austria-Hungary there is a waterfall with a total head of 395 feet. Above the falls a reservoir has been built from which water is carried to the top of a high bluff and from there projected down the steep slope through four steel pipes 63 inches in diameter. At the foot of the slope these terrific jets of water are directed against the blades of waterwheels, and the result is 6000 horsepower developed by each of the wheels. These in turn drive the electric generators. Such in brief is the great Manojlovac hydro-electric plant shown in the illustration. This is but one of a great number of water power plants built in Austria-Hungary in the last ten years, and producing current so cheaply that it is not only used for light and power but, very extensively, for heating and cooking.

Some SECRETS of Electrical Stagecraft

By T. J. Newlin

PART IV

THE HAIR RAISING LIGHTNING BOLT AS PRODUCED IN "KING LEAR."

In this scene the much-to-be-pitied, poor, old King Lear, after having divided his fortune among his two daughters, who flattered him into doing so by falsely claiming their great love, has finally been cast adrift, minus all of his rights, property and retinue of servants. With the few faithful adherents who follow and stand loyal to him, and who humor him in his madness, he is seen at the rise of curtain in this powerful scene, ragged and torn and with his hoary locks waving under the action of the howling wind. Both the streaked and flash lightning are seen playing intermittently, while the clouds are passing by hurriedly, each attempting to overtake the other in its mad, headlong rush.

At the very moment the distracted King Lear invokes the aid of heaven and curses and hurls maledictions upon his two faithless daughters, there is a rumble of thunder and a vivid flash of streaked lightning. Then, as portrayed in Fig. 21, with a roaring, sputtering sound the thunderbolt rushes down to the stage, and with a ripping, crashing blow it strikes the tree and explodes, hurling the tree asunder.

Nothing can compare to the amazement of the high pitched audience at this most realistic bolt of lightning which seems to be an actual, vivid manifestation of God's wrath.

In Fig. 22 is seen the apparatus as set to produce the lightning bolt. The stage lights are dimmed down in the foots and borders and, if it were not for the intermittent flashes of the spasmodic lightning, everything would be in almost total darkness. The tree is shown which breaks to pieces at the dotted lines when struck by the lightning bolt. In order to produce this lightning bolt there is stretched between the fly gallery and the floor at the foot of the tree a twisted iron wire cable with insulators at each end.

Riding on this cable is a grooved pulley (A) from which depends a weight (W). An arm projecting from this pulley carries a piece of carbon (C) which scrapes over the twisted iron wire cable. Until the bolt is started the pulley (A) is held at the upper end of the cable by a string. Leading from the stage outlet is an insulated twin conductor cable. One wire in this cable is connected to the positive terminal in the outlet and the other wire to the negative terminal. The

positive wire is then connected, as shown, to the twisted iron wire cable while the negative wire is connected through a resistance to the flexible, rubber covered wire just beneath the twisted iron wire. This flexible wire is connected to the arm which carries the carbon (C).

In order to blow up the tree at the moment the lightning bolt strikes it, there is placed beneath the tree a galvanized iron box containing a quantity of smokeless powder. In this box are two terminals, between which is stretched a single strand of 32 gauge copper wire, this wire coming in contact with the powder. The terminals are then connected, through a switch, to two other terminals in the stage outlet by means of a twin conductor cable. Manifestly, on closing the switch, current will pass through the copper wire and bring it to a high temperature, exploding the powder with a loud report.

Everything being in readiness, the cue is given and the stage electrician gives a strong pull on the flexible rubber covered wire. This breaks the string and the pulley (A) rapidly descends along the twisted iron wire cable. As it passes along, the carbon (C) rubs over the convolutions of the twisted wire and the circuit is made and broken very rapidly, causing a series of sparks which represent a veritable trail of fire, descending diagonally across the stage. At the moment the bolt reaches the foot of the tree the assistant electrician throws in the switch which explodes the powder and also, at the same instant, "props" pull the tree over and break it at the dotted lines. Altogether, this produces one of the most hair raising scenes ever shown by electricity on the stage.

FIG. 21.—THE LIGHTNING BOLT IN KING LEAR

TICKLING THE OPTIC NERVE

Nothing is prettier than to behold a scene wherein a beautiful river winds its

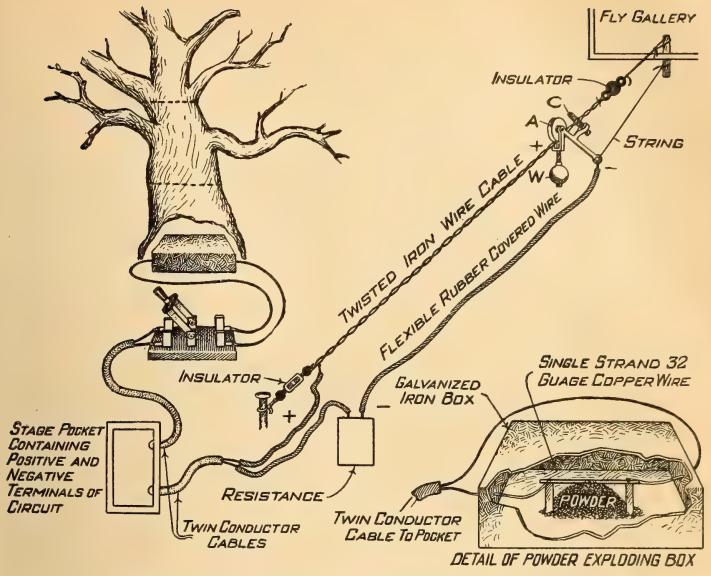


FIG. 22.—METHOD OF PRODUCING THE LIGHTNING BOLT IN KING LEAR

way across the background while silently and majestically the moon slowly rises, casting its silvery gleam upon the rippling waters below, as, intermittently, it playfully hides its smiling face behind a silver lined cloud. There are several ways of producing the rising moon effect on the stage. Some are from the brilliant brain of "those men behind," who cannot get too much credit for the contrivances they devise; and still another method is worked by the science of optics.

MOON EFFECT AS PRODUCED WITH MOTHER'S DOUGH PAN

Figure 23 represents a stage "set," showing a moon rising with the water ripple below. Formerly when this scene was shown one could readily wager that mother's dough pan had disappeared and would be missing for days to come. One of the detail drawings shows the said purloined pan with front opening covered with translucent brown paper, back of which is a sixteen candle-power incandescent lamp with a twin wire cable attached. A rope runs through the pulley (P) attached to the gridiron above. The twin wire cable hangs from the moon pan as shown, and is run to the fly gallery and inserted in the stage pocket.

At the opening of the scene the top of the moon is seen just projecting above the upper edge of the cloud on drop (D1) which sets "up stage" to about third entrance. The electrician then pulls the rope, causing the moon to gradually rise. As it gets fuller and fuller the water ripple is gradually brought into play, making the scene so realistic as almost to baffle the critical eye of a Reynolds or a Gibson, so true to Nature does it appear in comparison.

PRODUCING WATER RIPPLE BY THE SLITTED DROPS

The credit for this simple scheme should go to the ingenious brain of the stage carpenter, as this is directly in his line. Two drops are shown in detail in Fig. 23. While (D1), the one seen from the front stands still, (D2) is swayed or oscillated back and forth across stage in front of an electric arc lamp enclosed in a lamp house. Horizontal slits are cut in (D1) and (D2) in order that the light from the lamp may transmit its rays through the slits. The intermittent opening and closing of these apertures or slits as they coincide with each other in the two drops causes the rippling effect of water on the front drop (D1). Care should be exercised in order to prevent the rays from creating a glare. To offset this the electric lamp is set slightly to one side and light thrown on the rear drop at an angle of from 30 to 40 degrees. The back drop can be made just small enough to create the effect of a ripple if a large drop cannot be handled economically.

THE APPROVED MOON BOX

But of course the description I gave you of the dough pan applied to the

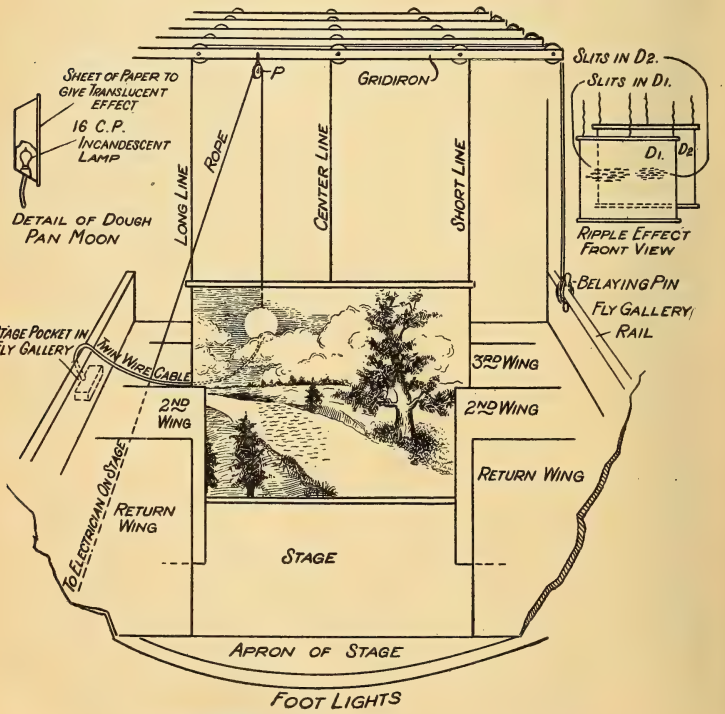


FIG. 23.—PRODUCTION OF AN ELECTRIC MOON AND WATER RIPPLE

"olden days." Today, no such crude methods will be tolerated, especially in the city of Chicago. The Iroquois Theater fire has taught the stage its immortal lesson. Shows coming from the great metropolis, New York, shake with nervous prostration as they near the Windy City, for fear the electrical effects they produce, such as lightning bolts, etc. will be turned down through rigid enforcement of the rules of the fire underwriters. So right here I will show you the approved moon pan and its construction that *will* pass in Chicago.

A casing of galvanized iron, shaped like a shallow box, contains four sixteen candlepower incandescent lamps as shown in Fig. 24. Over a circular flange on the outer face of the box is placed a sheet of translucent draughtsman's tracing cloth, and an iron band is thrust

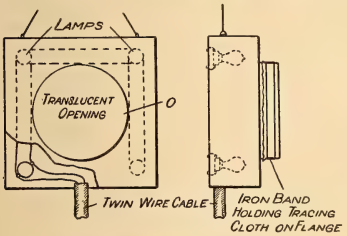


FIG. 24. THE APPROVED MOON PAN

down over it, holding it tightly over the flange like the head of a drum.

PRODUCING ILLUSIONS BY THE SCIENCE OF OPTICS

Optics: "That branch of physical science which treats of the Nature and properties of light and vision."

Every high class stage electrician usually makes a study of the science of optics; therefore you will not wonder that oftentimes he has the average optician "beat, going and coming," to use the slang phraseology of the stage. It is his field by the right of priority, and I can point out to you a dozen electricians who follow this vocation in the summer and who fit glasses by the science of optics for the aid of the human vision. In numerous instances they have brought about true vision where the regular optician has failed. A great many electrical effects or illusions nowadays are produced by optical lenses with colored scenes painted or photographed on glass, mica or other transparent mediums, representing moon, water-ripple, ocean swell, floating clouds, streaked lightning, fire scenes, rainbow, etc. The apparatus for producing these optical illusions it is my intention presently to show and explain to you. Even those who are up in the science of optics will wonder how so simple an affair will produce such wonderful results which from "out front" mystify the best of you. But before taking up this matter, let us look a little into the laws of light.

THE LAWS OF LIGHT APPLIED TO STAGE-CRAFT

All of the effects as previously enumerated, and any others produced by means of the sciopticon, are primarily founded upon the three principal sets of laws of optics, or laws of light, namely: Reflection, refraction, and absorption, as pertains to both light and lenses. It would therefore behoove the wise electrician to look further into the subject of light with its different methods of distribution.

Optics, as a science, is too lengthy to go into here in much detail, but for the benefit of the general reader I will explain a few rules as follows:

(1) Light is a physical force which emanates from all luminous objects and travels in straight lines in all directions, never in curves. If light did travel in curves, we would be able to look around a corner through a bent tube.

(2) The angle of incidence is equal to the angle of reflection. In other words, if a ray of light strikes a reflecting surface at a given angle with the perpendicular it will be reflected away from the surface at a similar angle beyond the perpendicular.

(3) The velocity of light is 186,000 miles per second when passing through the free ether.

(4) A ray of light passing from a rarer to a denser medium is retarded. This brings about what is known as refraction, or bending of the rays. For instance, if a ray of light passing through the air (rare) strikes obliquely upon the surface of a body of water (dense), the ray will continue on through the water, but at a greater angle than before. In other words, the ray is bent downward.

(5) A ray of light passing obliquely from a denser to a rarer medium is bent or refracted to a lesser angle with the surface upon emerging into the rarer medium. The course of a light ray through a medium of uniform density is, however, always a straight line.

(6) A ray of light passing from a denser to a rarer medium, or vice versa, but perpendicular to the surface, is not refracted or bent.

(7) Reflection of light is the bounding back of the rays of light into the medium from which they came. A mirror reflects light rays; a lens bends light rays.

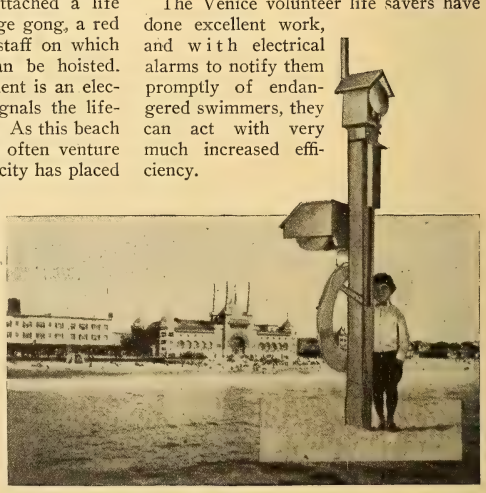
In the next chapter of this series, which will appear in an early issue, some applications of the science of optics to the production of stage illusions will be reviewed. These will include the simulation of moon effects, rainbow effects and the separation of colors by the prism. The work of the Sciopticon, or mammoth projecting machine, will also be taken up.—Editorial Note.

Electric Signal for Life Savers

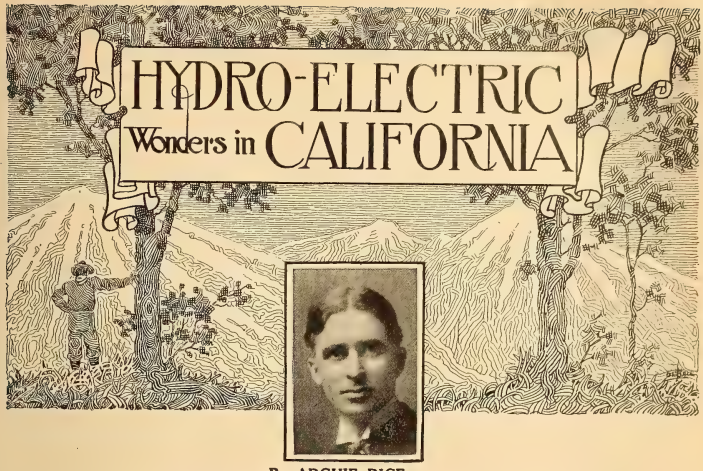
All along the miles of beach at Venice, Calif., the visitor sees at short distances apart a series of posts set upright in the sand. To each one is attached a life buoy, a reel of rope, a large gong, a red flag in a case, and a flagstaff on which another danger signal can be hoisted. In addition to this equipment is an electric push button which signals the life-saving crew at the station. As this beach is so long, and as bathers often venture into dangerous water, the city has placed these life-saving outfits on the strand and they have been the means of saving many lives.

The first aid to the imperiled swimmer is to use the electric push button, which summons the crew in their lifeboat. The next move would be for a volunteer to swim out with the life buoy to which a light line is attached which unreels as he proceeds. Meanwhile other spectators are supposed to operate the alarm gong and wave the red flag or hoist a signal to the flagstaff. In this manner the crew could locate the danger point at once and row for it.

The Venice volunteer life savers have done excellent work, and with electrical alarms to notify them promptly of endangered swimmers, they can act with very much increased efficiency.



BEACH AT VENICE, CALIF., AND ONE OF THE LIFE SAVING STATIONS



By ARCHIE RICE

This is the second article of the series. The first described how a famous gold-bearing river was diverted to produce hydraulic power. The electric energy was sent a long distance to operate huge gold-dredgers. They are riddling the river-beds and the adjacent land in a deep and desolating search for formerly unattainable auriferous gravel. The third article, which will appear in an early issue, will deal with one of the most characteristic mountain power plants, so remote and inaccessible that few have ever seen its wonders. — Editorial Note.

MOUNTAIN-MADE ELECTRICITY DOING THE WORK IN DEEP MINES

The Yuba River is an eastern branch of the Sacramento. It joins the main stream at the old mining town of Marysville, in the great valley. Back in the lofty Sierras the Yuba itself comes down out of three narrow cañons between heavily timbered lofty ridges.

On the south fork is the Yuba dam. There was a time when thousands of miners were scattered along the course and the little branches of the Yuba, washing panfuls of gravel to get the grains and flakes and nuggets of precious gold. And old miners are still working here and there, puttering out a fair livelihood on their private claims.

Way up in the mountains of the Yuba River country run the deep underground ledges of quartz that have held sealed through all the centuries the original sources of California's gold.

In Nevada County you see the top works of the mines that have punctured the earth nearly a mile deep with inclined or perpendicular elevator shafts. From the different floors ramify narrow, crooked hallways. They are dark and moist. The air is heavy and sultry. You feel oppressed. There is not a particle of gold in sight. It is hidden in infinitesimal particles in the chunks of grayish or whitish quartz. The underground hallways lead on and on, following the drift of the quartz veins.

At Nevada City one of these mines has produced more than $30,000,000. It is still steadily yielding a golden harvest to the unceasing labor of day and night shifts of three hundred workmen.

That gives you an idea of the importance of California's deep mining for gold. There are scores of these big mines along the so-called Mother Lode, the route of the original gold bearing ledges.

Now you can understand why there seemed to be a market up there for electric power. It might be used for the hoists and machinery in the mines and at the stamp-mills that smash up the quartz into powder from which chemical processes can dissolve the gold.

Early miners had dammed the Yuba. At many places they had diverted little streams in ditches to bring water to placer diggings at a distance from the river.

At the quartz mines water power from smaller streams was used to operate some of the machinery. This water power came through ditches and pipe lines from places higher up in the mountains.

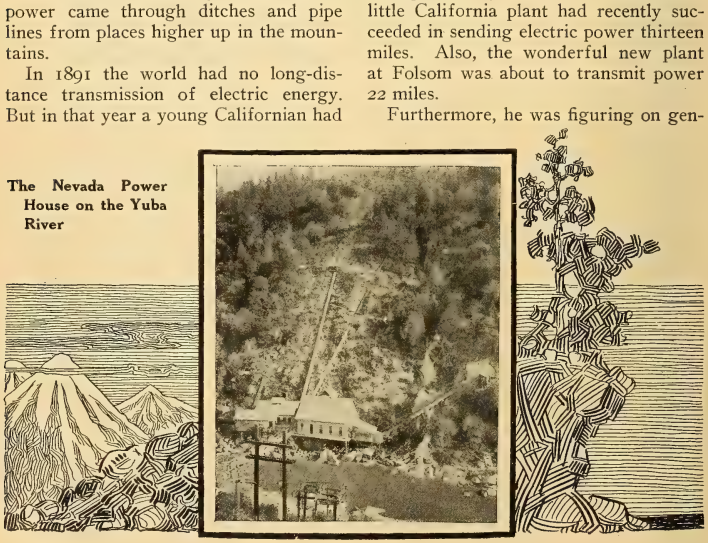
In 1891 the world had no long-distance transmission of electric energy. But in that year a young Californian had an idea that the thing could be done. He owned an interest in one of those mines at Nevada City.

Down behind a high ridge back of Nevada City runs the cañon of the south fork of the Yuba. It worms its way between the lessening ridges to reach the wide open valley, 20 or 30 miles below. The man with the idea went over into that Yuba cañon and prowled along up stream. He chose a site for the Yuba dam, and promptly started workmen on the job.

A wall of muddy water came eagerly hissing its way down the cañon in the spring of 1892. When the man went to look again his dam was gone. The log framework had held about as well as so many matches and wooden toothpicks in a gutter suddenly flushed by a fire-hydrant.

In August of 1895 the man tried again to build a Yuba dam that would stay where he put it. He still cherished his idea of four years before. It was strengthened by the fact that an obscure little California plant had recently succeeded in sending electric power thirteen miles. Also, the wonderful new plant at Folsom was about to transmit power 22 miles.

Furthermore, he was figuring on gen-



The Nevada Power House on the Yuba River

erating electricity by using a very high fall of water to produce swift force rather than ponderous volume.

The new Yuba dam was rushed to completion in three months. It had to be finished before the winter rains. A large force of men was kept constantly at the job. The heavy log cribwork was bolted down into the bedrock of the river. The framework was 28 feet high and 107 feet long across the cañon. It was to be filled with rock and gravel.

But before back filling could be started the river began to rise so rapidly that the workmen had to leave. Another torrent of muddy water came down and hid the dam.

After the flood they went back to look. Their hollow crib of logs had stuck. It was a solid masonry wall of gravel and "slickens" washed from the hydraulic mines further up in the mountains. It was a more substantial and enduring mass than they could have made.

Meanwhile a force of 110 men that had started work a month before the dam was begun got their special task completed just as the dam was finished. They had built a diverting flume system to carry water from the dam way out along the wooded and rocky slope of the left-hand bank of the river for a distance of a little more than three miles.

The downward trend of the river along there is nearly 100 feet to the mile. The flume was given a nicely surveyed even drop of only 26⅔ feet to the mile. Keeping well up along the hillside the flume finally reached a position where it had gained an elevation a little more than 200 feet above the river. From that height the water could be shot down through a pressure pipe with great force.

The flume is six feet wide and four and a half feet deep. It was intended to carry a constant flow of 5,800 miner's inches of water. A million and a quarter lineal feet of lumber were used in its construction.

Down at the bottom of the cañon, on the very brink of the river, a shelf was blasted in the solid granite at the high-water mark. And there one of California's historic hydro-electric plants was erected.

But while the actual construction work had been progressing on the dam and flume and foundations, there were greater temporary problems involving much labor. Heavy machinery was coming by rail from the east. There was no road from Nevada City. Each of the two generators weighed 11,200 pounds in one mass.

Men went to work widening and regrading three miles of old road that went up out of Nevada City like the roof of a house. Then two miles of entirely new road had to be built along and over a rocky and wooded ridge. That com-

A Typical Storage Reservoir in the Sierras

bination would get the heavy wagons out to a point half a mile up the steep slope directly over the power house and at a perpendicular height of 1,700 feet above it.

They made up their minds to lower the ponderous machinery down that half mile steep mountain slope.

Each wagon load that had come over from the town was pulled by twelve horses.

They lowered the valuable machinery cautiously down the mountain. The way had been cleared of the forest growth. Tree stumps served as capstans, about which the steel cable slowly unwound.

An avenue 60 feet wide up out of the cañon, over the ridges, and on toward the mines was hewn clean of forest growth. The smaller pine trees thus removed were used for the pole line, and that clear zone was its course. From the power house to Grass Valley the line is eight miles, and there is a way station at Nevada City, with sub-stations and transformers at both towns.

Heavy timbers clamped down by steel rods sulphured deep into the solid bedrock were the foundations upon which that little power plant established its generating machinery.

The end of the river flume was 298 feet up the slope; the actual perpendicular fall was 190 feet to the water wheels. A steel pipe three feet in diameter descended to seven pairs of nozzles, each pair striking into the windmill like little buckets of a water wheel. Three of these wheels were connected with one generator and four with the other. This force sent the generators revolving at 400 revolutions a minute. And the process produced 300 horsepower generated at a pressure of 5,500 volts.

At first the miners were very reluctant to experiment with this new power. Motors would cost money. Expensive changes would have to be made at the mines. The new enterprise might not be permanent.

Then some of the biggest deep mines tried it, and more.

The demand for power finally exceeded the capacity of the plant.

Early in 1898 an addition was made that marked another stage in the growth of California toward higher and higher water fall for her mountain power plants.

Straight up behind the power house and over the ridge nearly four miles was a little bowl-like mountain meadow with a narrow cañon outlet. So they acquired that land, went up there, built a dam across the outlet, cleared off the timber and created an

The Yuba Dam

artificial lake of 42 acres, or about the area of a dozen city blocks.

They built a line of flume and ditch 2¾ miles long out toward the ridge overlooking the power house. The waterway is four feet wide and three and a half feet deep. A gorge had to be crossed. A big U-shape pipe 668 feet long was put in the depression to serve as a huge syphon, taking the water from the flume at one side and carrying it up into the flume across the cañon.

The grade of the flume line was made so gentle, to get all the fall possible, that it takes the water an hour and ten minutes to flow a little less than three miles. That is only as fast as an ordinary person walks.

But out at the end of the flume, on the ridge, 1,870 feet up the slope behind the power house, this new source of water power attained a perpendicular elevation of 785 feet above the water wheels down at the station.

A 20 inch steel pipe was laid and anchored, to shoot water down from that higher source of power.

A new and larger section was added to the little original power house. Two more generators like the others were installed. All the water wheels were then connected to a common shaft, and the combined generating capacity of the plant was raised to a regular average of 1,600 horsepower.

Isolated in that narrow cañon, they were solving the hydro-electric problems peculiar to the climatic and geological conditions of California. At that little plant things were happening and changes were being made that led to California's marvelous and gigantic hydro-electric developments of the following decade.

Reliability of water flow is absolutely necessary to a hydro-electric plant.

From an old mining ditch tapping the Yuba River 70 miles further back in the mountains the original flume supply from the Yuba dam was augmented. The dam itself was fortified by a solid granite masonry wall. That lake created high over the ridge was supplied by water brought through several miles of ditch after it had been used at a little power house located higher in the mountains.

That other power house was getting its supply from a far reaching old mining ditch system, stretching away back to the snow places of the high Sierras and combining a chain of many mountain lakes as emergency reservoirs to maintain the supply.

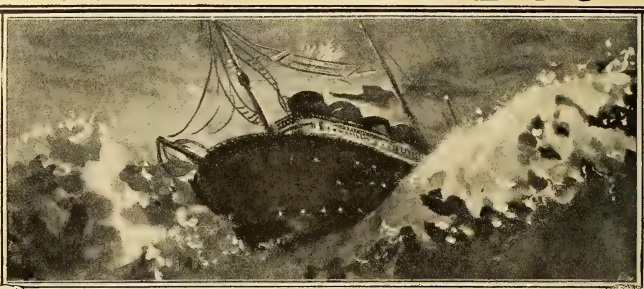
Today every big deep gold mine in California is run by electric power. And all the electric power is carried a long distance to the mines.

Rainfall records are not a reliable guide to the seasonal flow of water in California's mountain streams. The geological formation of the cañons is an important part of the problem. Where there is no river cañon the rainfall runs off quickly and is lost.

Forests and vegetation merely check the sudden run-off of rains. But where the geological formation is favorable the water seeps down into the slopes and later slowly percolates into innumerable little springs that maintain the stream long after the rainy season.

By their mammoth harvest of water in California's mountains the hydro-electric plants greatly benefit the farms and orchards. The flood waters they store in artificial reservoirs they hold for the summer season. When the rivers become low the storage lakes are made to yield their quota to run the plants.

THE WIRELESS



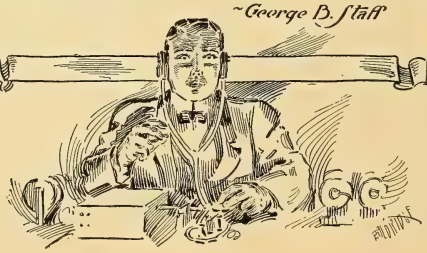
The storm king's flying squadrons sweep
With fury o'er the sea,
Before the monarch of the deep
The ships in terror flee.

For ages past the storm king's hand
Has ever claimed its own,
And held the scepter of command
O'er seas he ruled alone.

But now a rival seeks the field;
A foe as swift as light.
The squadrons of the storm king yield
Their spoils before his might.

His silent sentries on patrol
Outspeed the king of storm,
And when he seeks to wrest his toll
They flash the swift alarm!

~George D. Staff



"The Romance of Wireless"

By EDWARD LYELL FOX

If Guglielmo Marconi had not been a man of strong character, resource and patience the sinking of the *Titanic* would have been a disaster blacker even than Martinique. Because of this man, his mind, his determination, his achievement, hundreds of the great ship's passengers were saved.

Yet, when I read the newspapers, I saw no tribute to this man to whom so much was due. I read columns about noted people who had been saved, about those who had gone down. I saw the pictures of society women who had escaped in the lifeboats. I saw plans for new safety appliances, photographs of other liners that had sunk in years gone by—but no extensive mention of Marconi. Indeed, it was not until a Senate commission began an investigation that his photograph was printed. Then it was printed only because he was one of the witnesses. The story of the man was not told—the story that had its climax in the dark *Titanic*. And this is the story that POPULAR ELECTRICITY has asked me to write—"The Romance of Wireless." For "romance" it is. Listen:

Photo by Brown Bros.

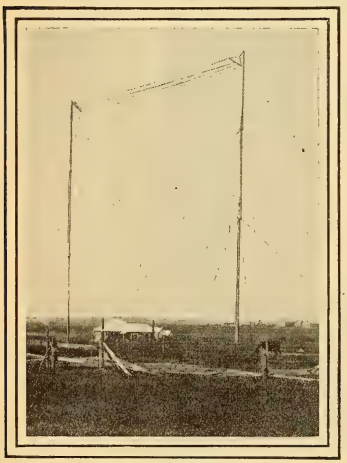
GUGLIELMO MARCONI

In the shade of the Mareşcalchi Palace stands a small house. If you visit Bologna, that quaint Italian city, your guide will stop before that house almost reverently. In it was born Marconi, and the natives have come, you see, to look upon him almost as an immortal. It was on April 25, 1874, that Marconi was born. The son of Joseph Marconi, by a second marriage, the baby was fortunate in coming of an Irish mother. Not infrequently the intermarriage of these races produces a genius. And this was one of the cases. From his mother—keen, gray-eyed Anna Jameson—came persistence and alertness which has stood him in good stead; from his father came the Italian power of invention and conception.

At sixteen Guglielmo was a keen student of mathematics, chemistry and electricity. These studies were pursued in a school at Florence, and to the attractiveness of its courses is due the step that resulted in Marconi specializing in electricity.

After Florence, he went to Leghorn and astounded the instructors there by his passion for anything pertaining to electricity. He is said to have spent fifteen hours of the day in working over his books and instruments. Becoming master of the fundamentals with the speed that bewildered all Leghorn, Marconi insisted that the professors give him problems that perplexed even the most learned of them. And always he solved them and always he confounded his teachers by the depth of his questions.

In 1894 when Marconi was immersed



A HIGH POWER MARCONI STATION

in his researches there came to him a letter. It was from his half-brother, Luigi, who realized that Guglielmo was overworking. Now Luigi owned a pretty villa at Andorno. To this quiet haven he wanted Guglielmo to come. He wanted him to take a long rest before going back to his work; also planned a number of entertainments.

One day while Guglielmo was walking through the gardens, thinking of the fête that was to be held for him the next day, an idea came suddenly, driving everything before it. It was to use the Hertzian electrical wave as a medium of communication. Instantly he forgot the villa, the gardens, the blue Italian sky—everything but the Idea. Hurrying to his room, he began working with pencil and paper, figuring out problems, making little drawings, crossing out everything and doing it all over.

The luncheon hour came and was gone. Guglielmo didn't know it. When Luigi knocked at the door of his room he did not hear him. When the door was opened he did not see him. All he saw was the calculations he had made and the Idea that floated vaguely, ever changing like a chameleon. The shadows began to deepen in the garden and yellowing evening dropped over the hills. Still Guglielmo worked on. He went without supper. The Idea was food enough. And so he worked way into the black hours of the night—worked until Luigi insisted that he take food and rest.

The next morning Guglielmo packed his bag and hurried home. The entertainments and fêtes were never held. Something new in electricity had called him. Upon arriving at Bologna, he went immediately to his little laboratory. He put the Idea to an experimental test. It was a failure. He tried other tests. They were failures. He began to work until the early mornings. He lost interest in everything else. Often he forgot to eat. He began to grow gaunt. His face looked drawn and wan. His eyes had a way of blazing suddenly. His family began to get worried. They protested against this mad idea—the folly of sending messages by electricity through void. Scientists who had heard of Marconi and what he was doing stroked their Van Dykes and smiled. At the scientific clubs he was the butt of jokes and ridicule. Some of them came to jeer whenever he appeared. "Mad Marconi" they began to call him.

That is, everybody laughed, except one man. He was Professor Augusto Righi, one of the most famous Italian savants.

Feeling that Marconi was a genius who had stumbled upon a wonderful invention, he invited him to Montese. There the professor had a beautiful summer home, and Marconi was made to feel that it was his own. Together they began to make experiments. Also, these were failures. Then came a day when one of the tests worked the way they hoped it would. The Idea was a reality.

But instead of proclaiming to the scoffers that "Mad Marconi's" dream had been fulfilled, they continued their work quietly. The others would know in time. Marconi was becoming resourceful as well as alert. And so they worked day after day, removed from the world in the little laboratory at Montese—worked until they brought their experiments to a stage that warranted them being made in public. Then they went down to the University of Bologna—down to the jeerers and scoffers. To them they showed a wonderful series of experiments, wonderful results. And the doubters rubbed their eyes and believed.

After working around Bologna, Marconi went to England. Here he continued his experiments. He established stations at Penarth and Western. Above the quiet English countryside there began to sound the crack and the splutter of the wireless messages sent and received.

The English newspapers began to tell about the slender, good-looking young Italian and the work he was doing. Reports went back to Italy, to the government, to the King. Then it was that the King directed that Marconi be invited to continue his experiments under the auspices of the Italian Ministry of War at Spezia. That was in 1898. Italy was wise. Other governments were beginning to show official recognition of Marconi's work. So heeding the call he returned to Bologna.

But with each success Marconi was becoming more and more resourceful, more independent. One day when he was at Penarth he received a telegram commanding his presence at Windsor Castle. It was in Queen Victoria's reign. When the message came to the local post office the people were in a great state of excitement. It was in the forenoon and the word had come to hurry to Windsor. But this excitement was as nothing compared to the shock sustained in the post office when Marconi sent word back that he could not go to Windsor on that afternoon, but he would the next day. The independence of him astounded those stolid Britishers. And to that independence is due much of Marconi's success.

In 1899 he began to attract the whole world. He did this because he showed that wireless telegraphy was a sound commercial proposition. Up to this time people had regarded it in the nature of a wonderful scientific dream come true. After working at Bologna, Marconi went to France. Here he conducted a series of experiments under the patronage of a French commission. To do this work he built a station at Windreux, France, another at South Foreland Lightship, and another on the French battleship *Ibis*. Messages were sent from these stations to the *Ibis*. The *Ibis* answered them. So was it demonstrated that messages could be received and sent from a station that was in motion.

So when he received a request for the use of the wireless in reporting one of the English-American yacht races he was ready for the test. And test it was, for the newspapers were depending on the wireless for news of that race. If the wireless fell down Marconi would be lampooned the length and breadth of America. On the other hand, if it succeeded, he would have the backing of a powerful press. Of course it succeeded. Everything Marconi did these days was a success.

Indeed so sure was he of himself that he had a wireless apparatus rigged up on the steamer *St. Paul*. After seeing his instruments in place he announced that he was going to receive the news from ashore and print it in a little news-

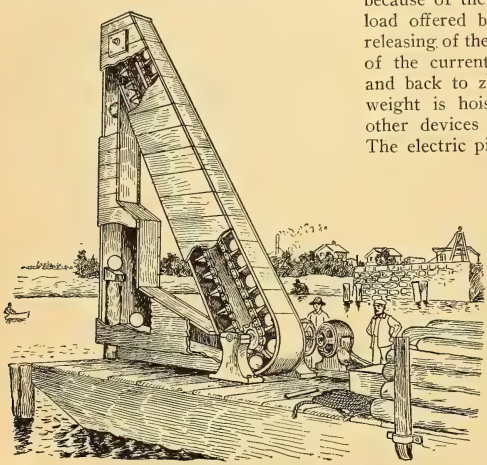
paper on board the steamer. He did. The paper was called the *Trans-Atlantic Times,* and sold for $1.00 a copy. Marconi turned over the proceeds to the seamen's fund. Not only was he resourceful, but wise.

But Marconi was not satisfied. Remember, his mother was Irish. He began to think of sending a message from one side of the Atlantic to the other. How the first message was sent across the Atlantic from American soil was told you in the April number of this magazine. Later, on January 19, 1903, Marconi succeeded in sending greetings from President Roosevelt to King Edward. The message hummed through space a distance of 3,000 miles—quite different from the vague dream of Andorno. The following March the London *Times* printed a 200 word dispatch received by wireless from New York. And that demonstrated beyond all doubt the availability of wireless as a means of trans-Atlantic communication. Since then many improvements have been made; improvements that made possible the saving of some of the *Titanic* passengers.

And Marconi is just beginning. He is never satisfied. That is because of his strong character. Those who are satisfied with themselves seldom accomplish much. Unlike most inventors, Marconi does not mind adverse criticism. He is determined, you see, to get the best results. He will listen to praise and will be pleased with it—because he is Italian. He will listen to praise and forget it—because he is Irish. A man of wonderful patience, acute observation, active imagination and a natural, practical skill, he was able to overcome the obstacles that another man would have fallen before. From the jeers of the savants of Bologna to the savior of those who saw the *Titanic* plunge beneath the dark waters is a long step. But Marconi made it possible because he is Marconi. Also, because he put electricity to one of the infinite uses that it offers to him who will take.

An Odd Pile Driver

The application of electricity to the pile driver has been heretofore impossible because of the extreme variation of the load offered by the lifting and sudden releasing of the driving weight. The rise of the current from zero to full load and back to zero again every time the weight is hoisted and dropped affects other devices fed by the same mains. The electric pile driver invented by the late Caryl D. Haskins, noted engineer of Schenectady, N. Y., provides a steady load. Heavy metal balls are lifted by a conveyor to a point directly over the pile, the head of which is provided with a metal cap. The balls drop in quick succession upon the head of the pile, driving it down and then pass on and are picked up once more by the traveling conveyor.



AN ODD PILE DRIVER

Electrical Securities

The Present Situation and the Reasons Why it is the Best Time in which to Invest in the Stocks and Bonds of Electrical Enterprises — Something About the Price of Stocks and Bonds and the Market Fluctuations.

By "CONTANGO"

In various instances, with some of which you may be familiar, individuals have done well for themselves by taking the initiative and establishing electric plants in this or that center. With high rates and a local monopoly for their undertakings, there has been the opportunity, at least, for them to keep much of the benefit and profit to themselves. Today this condition is undergoing a rapid and remarkable change. Larger companies, by the process already described in previous articles, are absorbing the smaller. Big combinations are absorbing the comparatively large groups and one after the other controlling companies are being formed. These controlling and operating companies link village with village, town with town, city with city. To do this large amounts of stocks, that is, shares, are offered for public subscription and large amounts of bonds are also offered to the public in which to invest its funds. Here, then, is your opportunity.

It cannot be too strongly stated that in nearly all cases there is nothing to lose but everything to gain by such combinations of capital and managerial ability. It means growth, and rapid growth, all along the line, with the best of security behind your bonds and the certainty of increased business in front of your stock ownership or holdings of shares. But with this growth, with this linking up or absorption of small systems into the larger ones goes naturally a higher price for the shares and an increased difficulty in obtaining the bonds without considerable premium, particularly if they represent issues of the older and more firmly established corporations and have a fairly long period to run. Therefore the opportunity to get the best as it comes before you should never be passed by.

It is not possible nor permissible to give here the names of the various companies or pass on their particular merits at this time. That must be left to your own judgment for the present. But we have given much information in these pages as to how that judgment should be guided and what to consider and to whom to go when in doubt. How to discriminate concerning the announcements made, whether by advertisements or circular personally addressed to you.

This and the following article in the August issue will give you further particulars as to the proper prices to pay, the best kind of bonds to buy, the reasons for their varying periods of maturity, the relation of the price to the term of maturity, the average yield for them at the varying prices; then also the matter of fluctuations in stocks will be more specifically dealt with, the returns on such stock, the sale of it or of bonds when desired or necessary.

The protection given to your investments, be it in the stocks or securities of these enterprises, is really much greater than appears on the surface. In proportion as they are part of, or amalgamated with, the larger interests so do you have the protection of the greatest financial institutions in the country and indeed in the world for that matter. The part is never greater than the whole, but the part is, in healthy conditions, as important as the whole in all these systems. For it is the concentration of successfully operated parts that makes for the success of the whole system. Understanding this as all able business men and managers of the local plants and installations do, you

should be reasonably sure of the proper care and consideration of each link forming the whole chain and that the great central station or controlling center will be operated in the most efficient and economical manner. But you yourself have perhaps only a slight knowledge of the promoters, operators or organizers of such enterprises. You have therefore to depend finally on the reputation of the bond or brokerage firms offering the shares or bonds for sale.

Before going into the question of prices made to you for bonds or shares or the market fluctuations in the price of the latter, let us consider once more the present situation and future prospect in so far as they are of interest to you who are asked to buy the shares of, or invest your money in the bonds of, electrical enterprises and organizations.

To begin with, business all over the country is considered good and there is not a valid reason for any setback on account of its being the year of a presidential election. On the contrary, every indication points to continued movement in the buying and selling of shares in the latter part of the year and a further advance in their price. Therefore you will do well to get the best prices you can at the present time. A large amount of bonds of all manner of large enterprises, not to forget both retiring and new bonds of older corporations put out the first six months of this year, has been readily absorbed. During May and June, while bond houses as a whole had plenty to do, there was a lull and the volume of offerings was considerably smaller than earlier in the year. Now as this is an all round good year, it means you will have plenty of good bond opportunities in the early fall, but the point is to avail yourself of the chances presented by being first subscribers.

In the main you will, as time passes, be given your choice of investing in stocks and securities of four classes—steam railways, industrial, that is, manufacturing and distributing companies, street and interurban railways and gas and electric properties. We are chiefly concerned with "Electrics," as they are called.

Therefore, it must once more be impressed on you that the earnings of railways fluctuate. When crops and business are good, railways flourish and the earnings increase; likewise the prices of the securities go up; on the other hand, during business depression prices of railway stocks and bonds go down. These fluctuations do not as a rule seriously affect the price of the bonds, but they do affect the market for the stocks, and what is true concerning steam railways is also true in regard to industrial shares and bonds. In this class is included manufacturing, the steel industry, sugar refining, biscuit and baking companies, smelters and the like.

The industrial class is subject to more violent fluctuations in gross and net earnings than any other. It is extremely sensitive and quickly feels the effect of changes in business conditions. It should, however, be observed that this is not so marked in regard to those industrials which are engaged in the supplying of human necessities. Nevertheless, they are to a certain extent the pulse of trade and respond very promptly to changes. The prices of the stocks and bonds, then, of such enterprises go up and down as do the earnings. They are traded in by speculators, who would rather deal in shares having a wide range of price than in those of a more stable character. What is true of industrials in this regard is also true of steam railways.

Street and interurban railway stocks and bonds have in recent years become more desirable to investors than formerly, owing to many things that have contributed to their stability and earning capacity—better management, the joining together and connecting up of the smaller lines into large systems forming in certain parts of the country a perfect network of electric transportation, also the steady increase in the population and the continued prosperity of the rural com-

munities. The earnings of street railways are less affected by general trade conditions than those of either steam railways or industrials, and as time goes on their shares and bonds will be regarded more favorably and will undoubtedly sell on a higher level.

As to gas and electric companies—to quote an eminent authority, member of a well known engineering firm specializing in such properties: "Those who have studied the four main classes of investments placed before the public to-day and examined into the merits and earnings of the various concerns are thoroughly and lastingly convinced that gas and electric companies show less fluctuation in earnings than any other class of business. One must understand the underlying facts and sources of revenue to appreciate the truth and strength of this broad statement."

Electric companies do not primarily depend upon the crops or general conditions of trade or business. They depend upon the population of the cities served, and this does not fluctuate, but, taking it by and large, shows a steady increase in all sections of the country. The commodity sold is, too, a household and industrial necessity, therefore the consumption of electricity during periods of business depression does not fall off to any noticeable degree. So, for the same reason, during periods of great financial prosperity, the earnings continue to show the usual rate of growth, slightly increased by the added expenditure on the part of patrons in the direction of the purchase of electrical conveniences and contrivances.

When business conditions are unfavorable, places of amusement are not, it is true, so well patronized, but they are just as brightly lighted as when times are prosperous and every seat taken. Then, too, when people are not at the theaters, they are probably at home where the same amount of fuel and light is consumed at one time as another, regardless of financial conditions. The use of electricity for power and manufacturing purposes may fall off somewhat when there is business depression and a tightness in the money market, but this falling off in the gross earnings from the sale of power is offset in the net result by the saving effected in the purchase of machinery, equipment, fuel and supplies at the lower prices.

Statistics show that the earnings of electric companies maintain a continual increase from year to year with no falling off in years of panic or bad business conditions. Rates for electricity are practically unaffected by outside conditions, and might be maintained constant, though as a matter of fact, with the increasing spread in its use, there is a corresponding ability to make lower rates to the public, which is done voluntarily in a great many cases and without reducing the dividends to which the stockholders are justly entitled.

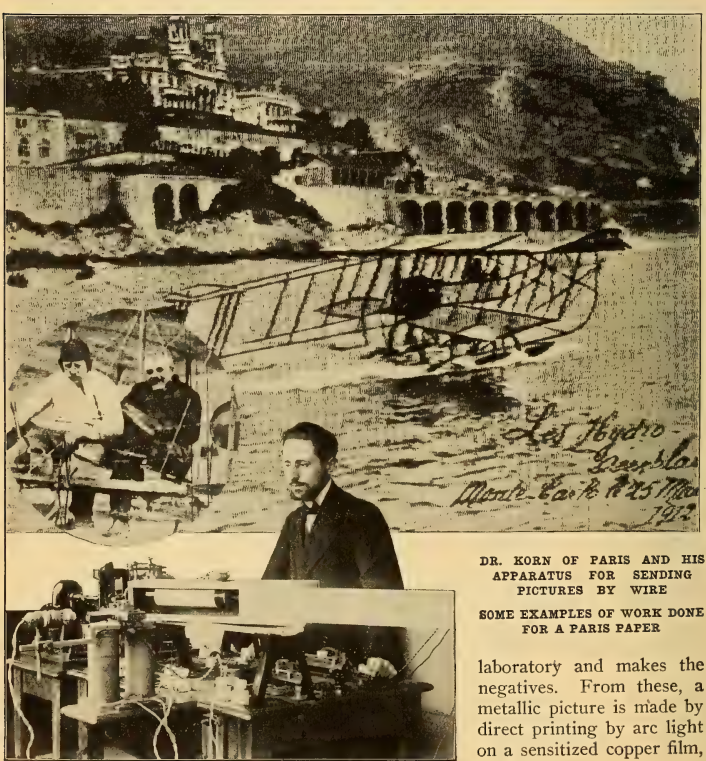
There is authority for the statement that the losses sustained by investors on account of foreclosure of electric mortgages, or default in the payment of the interest on the bonds, have been less than the losses to depositors in national banks, which have not been as high as one-tenth of one per cent. For assured and steady increase in earnings, therefore, electric companies cannot be beaten. If you can invest your money in securities that will earn from 5 to 6 per cent the profits will be correspondingly larger than if you invest at a lower rate, and while it has been usual to assume that very low income-bearing securities are the safest, yet every year the safety of electric investments is increasing so that they are just as safe as the old low-priced securities, yet bring in much better returns.

Picture Sending by Wire

Although the transmission of pictures by wire and even by wireless was made possible quite a number of years ago no considerable practical use has been made of the discovery; that is, not until just recently, when a number of Paris newspapers adopted the plan.

A station is installed at Monte Carlo, the center of the Rurera region, where there are always interesting affairs happening, and a second station is located at the headquarters of *Illustration,* the leading Paris illustrated weekly. The distance is about 500 miles.

The electrical picture apparatus which is shown here is quite a new one and has been running only a short time. Dr. Korn, the inventor, found that it was not much advantage to use the action of light on selenium for sending the pictures, as he employed in his former apparatus, as it is much easier to use an electric contact running over a metallic photograph. At Monte Carlo the photographic reporter takes views, say of an aeroplane flight, and brings them to his



DR. KORN OF PARIS AND HIS APPARATUS FOR SENDING PICTURES BY WIRE

SOME EXAMPLES OF WORK DONE FOR A PARIS PAPER

laboratory and makes the negatives. From these, a metallic picture is made by direct printing by arc light on a sensitized copper film,

so that the result is about like a halftone engraving except that parallel lines are used for the image instead of small dots. The copper film is quickly prepared, about like a photographic print, and it is then ready to be put into the electrical picture sender.

The operator wraps the film around a cylinder and it revolves like a phonograph cylinder so that a fixed metal point runs across all the lines, and when it strikes the bare copper it sends current. When crossing a black line made of the insulating gelatine film, no current passes, thus translating the picture into current impulses over the line.

At Paris, a shutter worked by the electric current of the line, sends a beam of light from a lamp through a pinhole in the box containing a film wrapped around a cylinder, so that the light prints a duplicate picture on the film. The operator develops it, and the photograph then goes to the engraving room to have a halftone engraving made for printing in the paper.

An Electrical Genius Released from Prison

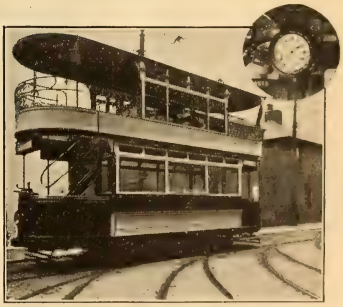
In order to procure a patent for an invention to draw electricity from the atmosphere and produce power therewith, a convict in the Arizona state penitentiary at Florence was recently ordered released by Governor Hunt for a period of 30 days. An order was forwarded to the warden of the penitentiary to that effect, and the prisoner, Roy J. Meyers, will shortly proceed to the capital, without guard, and after securing the patent will return and surrender himself to the prison authorities. It is not expected that a pardon will be granted, but in view of the importance of the electrical device, which Meyers is said to have perfected in his cell, the authorities are willing to release the inventor for a month "on honor" so that the invention may be given to the world.

Meyer's case was brought before the Arizona legislature by Miss Kate Bernard, superintendent of Charities and Corrections in Oklahoma, who made an eloquent and convincing plea in the man's behalf. She stated that a model of the device had been made in the penitentiary which had operated a 25-horsepower engine with electricity derived from the atmosphere. On advice of his friends, the model and blue prints were destroyed, but the prisoner will be able to duplicate them in Washington, and is confident of obtaining his patents. The House was so impressed by Miss Bernard's speech that a vote sustaining the governor's action was taken.

A subscription was taken for the purpose of defraying the expenses of the trip and the patent office fees, Miss Bernard heading the list with $50.

Electric Clocks in Tramcars

It is believed that the electric railway system in Belfast, Ireland, is the only



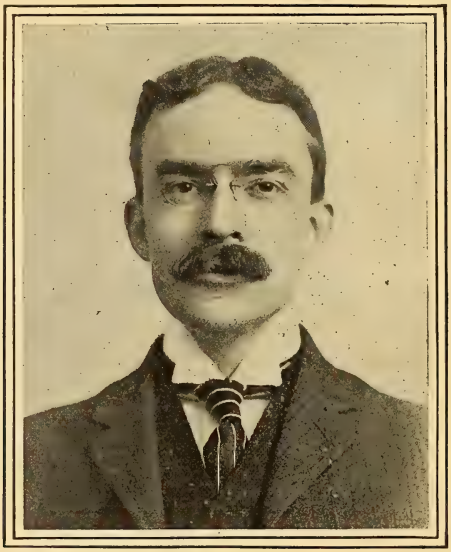
BELFAST TRAMCAR PROVIDED WITH ELECTRIC CLOCK

one employing electric clocks in its cars, some of which are of the double decked type shown in the picture. The clocks are actuated by two small dry cells which last from eighteen months to two years without renewal. The clock gets an impulse every minute which gives power to a spring which keeps the clock going for one minute, when it receives a second impulse.

Ambition

By WINDER ELWELL GOLDSBOROUGH, M. E.

Extracts from an address made in 1906 by Mr. Goldsborough, then Vice-President of the American Institute of Electrical Engineers, to the students of the Thomas S. Clarkson Memorial School of Technology, and published through the courtesy of Waddell and Harrington, consulting engineers, from a book edited by them entitled "Addresses to Engineering Students." This is the first of a series of similar articles by prominent educators and business men, which will be especially interesting to boys and young men who contemplate following the engineering profession.—Editorial Note.



We have a great misconception of what "work" is. When I was a boy, work meant discomfiture to me. I always heard work or labor spoken of as something that no one wanted to do.

Now there are various definitions to be given to work, and the generally accepted definition of it is wrong. To my mind work is any agreeable and at the same time useful thing which a man has to do—the thing which he wants to do. It makes no difference what that thing is.

But are there many of us here who have not felt the thrill that comes with the perfection of some one thing in which we have our heart? What young engineer, after he has created through his plans, designs and work, a large engineering plant, would be willing to be absent from the starting up of that plant for any social function or any pleasure of field or sport which you could offer him? It is

the essence of his success. His life blood has gone into the plant. It is a creature of life and being to him. And he would not give up the pleasure of being there; of working all night; of experiencing any discomfort to make that plant a success, for anything else you could give to him.

It is not the money, it is not the gain, which makes men in this country. America has been accused of being a country in which only gain is sought. That is not true. I have come in contact with too many of our men; I have seen too many of our boys; I have had them work too close to me ever for one moment to think that the dominant idea in the brains of our men and boys is money.

There are many things which a young man has to learn if he would succeed; and all of us want to succeed. If we could only, when we start out, have the knowledge of the ways and methods of mankind that we acquire in later years, it would be very valuable to use. We can't learn those things by having them told to us, because they somehow slip away. If you visit an engineering structure and study it, you can always carry it in mind and remember it and have it as a direct asset; but if you only learn of it by hearsay, you may or may not be able to retain a memory of it. And so it is with experience. We must learn it at first hand. We must acquire it for ourselves. Then why should any young man be willing during two or three or four years of his life to stay in one shop and learn but one thing, when there are so many things to learn?

I once was conversing with Dr. Robt. H. Thurston. I had been out of college about three years, and in talking over the situation with him I apologized because the old saying "A rolling stone gathers no moss" did not seem to be exemplified in what I had been doing, as I had changed my position several times in the three years. He said, "Don't worry about that. A rolling stone is the only one that gets polished." That set me to thinking. If the rolling stone gets polished—if you want a high polish, you have to roll a good deal.

So the thing for a young man to do is to get out in life and to learn all he can in one position, and then, as soon as he has acquired the better part of the knowledge of one—he is young—he ought to break off, and get another place, even if he has to begin all over again. Because—think of the experience he is going to get in the new place, the new problems he is going to have to solve.

Make trouble for yourselves, or at least what the world calls trouble; and with deliberate aforethought, if need be. Change conditions around. You have but so many years to live. And before you are 30 years old you must acquire a good deal of information.

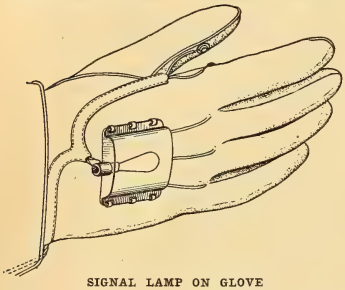
Deciphering Manuscripts With Ultra-violet Rays

In Europe, where quartz lamps have already been introduced on a commercial scale, photographers have found that they can obtain very different effects when using these lamps in place of the more common sources of light. The reason is simple enough. The quartz allows the ready passing of the so-called ultra-violet rays of light which will not penetrate glass, and these in turn produce a different effect from the rest of the rays.

With colored vases, flowers or dress goods the effects are equally surprising and sometimes may lead to important applications. For instance, a Berlin photographer (A. Mente) has found that ink which has faded into illegibility may still be opaque to the ultra-violet rays. By photographing documents on which the ink had faded, he has been able to restore the legibility. Moreover, he has found that in some old parchments, dating back to the Twelfth Century, his quartz light photographs showed the original wording which had later been changed in a still legible ink. Such a deciphering of old manuscripts which heretofore have not been readable ought to add greatly to our knowledge of previous centuries.

Signal Lamp on Glove.

A wave of the hand may serve the automobile driver at night in notifying vehicles behind that he desires to turn out or stop, if a glove with an electric lamp mounted upon it is made use of.

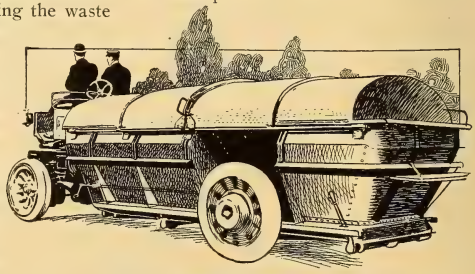


SIGNAL LAMP ON GLOVE

The inventor is Charles A. Schindler, West Hoboken, N. J. The lamp, enclosed by a transparent cover, is secured to the back of the glove. Flexible wires from the lamp connect to a battery and current is turned on by bringing the contacts on the thumb and first finger together.

Electric Refuse Wagons of Paris

The new silent running electric wagon for collecting household waste is likely to be appreciated in Paris, where it is now being introduced. As the majority of houses in the city are apartment houses which front entirely on the street, a proper method of collecting the waste had to be organized, and this was done some years ago by using large galvanized iron boxes, which were filled up by the tenants generally during the night and were then set out on the pavement by the janitor early in the morning, so that the carts could collect from them. The new automobile wagons will be quite an improvement and will do the work much quicker. The present wagons are designed to make a trip of about 20 miles a day. All the electrical gear, with storage battery, is put together in the front part along with the two front wheels, so that the front truck can be separated from the main body.



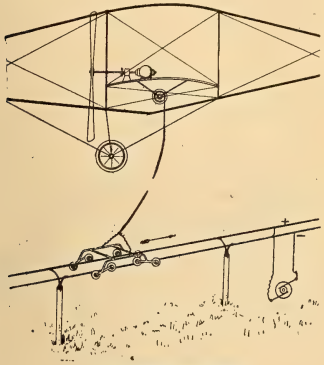
ELECTRIC REFUSE WAGON IN PARIS

A "Boiling" Battery

A Paris inventor has just brought out what may be called a "boiling" battery, and claims that it will give six times as much power as the usual type. To show how the battery acts, he makes the following experiment. He takes a porcelain vessel which will stand the heat of the fire, or probably an ordinary enameled vessel would do, and fills it with a weak acid solution, or, better, a bichromate battery solution. Two carbon plates are put in, leaving a middle space. A zinc rod or plate is attached to a wood handle so as to dip it into the bath between the carbons. A small, low voltage incandescent lamp is connected to the carbons and the zinc in the usual way. On dipping in the zinc the current given by the battery cell is very small, and the lamp will hardly glow. Removing the zinc he puts a small flame under the vessel so as to bring it about to a boil. Putting in the zinc again it is found that the lamp now glows brightly, and the inventor claims that the current, which he measured by instruments, is six times as much. His method is the subject of a French patent.

Trolley Wires for Airship

To Theodore T. Kryshtofovich, St. Louis, Mo., has been granted a patent upon an invention for transmitting electricity to aerial vehicles. The air ma-



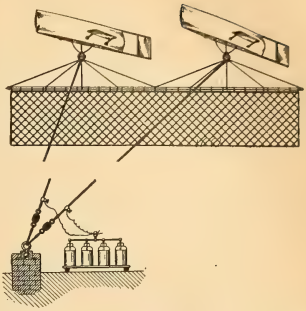
AN AIRSHIP TROLLEY

chine is equipped with a motor from which a two wire cable passes downward from a reel to a two wire trolley arrangement. By guiding the aerial craft along above the trolley the airship may be propelled by electric motors.

Collecting Static Electricity From the Air

Ever since the days of Franklin's kite inventors have been busy upon schemes for obtaining energy from the sun, wind and waves.

One of the latest ideas for collecting energy is to suspend a metallic screen in the air by means of a number of elongated balloons built to stand the wind by being equipped with rudders. Assuming that the screen will collect static electricity from the atmosphere, the screen is anchored by conducting wires which are connected to several Leyden jars for storing up the captured charges.



APPARATUS FOR COLLECTING STATIC ELECTRICITY

First Money Earned from Telephone

"On February 12, 1877," relates Dr. Bell, "I gave a lecture before the Essex Institute in Salem, Massachusetts, and the lines were connected with Boston. The speech was transmitted between Boston and Salem, and the audience generally could hear the sound of the speaker's voice, while those who came close to the telephone were able to converse with Mr. Watson in Boston. At the invitation of the Essex Institute this lecture was repeated on February 23, 1877. An admission fee was charged, and on this occasion certain of the proceeds were presented to me for my lecture on the telephone. I immediately went into Boston and we had a little silver telephone made, and it is interesting now to look back upon the fact that that was made from the first money made from the telephone.

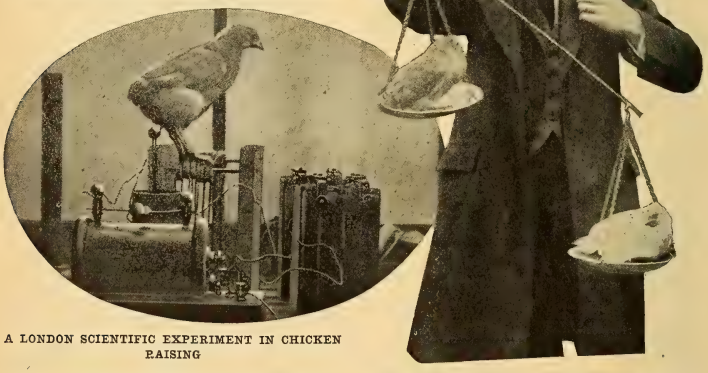
"On that occasion a very interesting incident took place. A Boston Globe reporter had a brilliant idea that he would send a despatch to his paper in Boston by telephone, and on that occasion the first newspaper despatch ever sent by telephone was sent to Boston for the Boston Globe. That, I think, more than anything else, woke up the press of the world to the advantage of the telephone. That article in the Boston Globe was copied all over the world, and had a great influence."

Electric Chickens

The electric chickens have won! T. Thorne Baker, a London scientific expert, has concluded experiments in treating young fowls with high frequency electricity—the kind of electricity used in wireless telegraphy—with highly satisfactory results.

The birds thus treated are asserted to have put on 38.5 per cent more weight than those that were not treated. With the exception of the electric treatment, the birds were reared as nearly as possible under the same conditions on the same food and in the same incubators, in the same garden.

The only difference was that the electrified chickens seemed happier and more placid and obviously were plumper, as the result of the high frequency, high voltage alternating current in which they basked.



A LONDON SCIENTIFIC EXPERIMENT IN CHICKEN RAISING

The final result of the experiment is as follows:

"The cost of the treatment works out at ¼ cent per chicken," says Mr. Baker, "so that the treatment is well within the means of the chicken farmer who raises on a commercial basis, and the idea is obviously well worth his attention." The incubators used were the Hearson patent, made by Messrs. Spratt, of London, England.

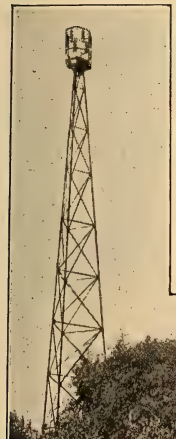
First Foreign Language Over Telephone

According to Dr. Alexander Graham Bell, the first foreign language transmitted by telephone was Japanese. In telling about it recently he said:

In the early part of 1877 or the end of the year 1876, a rather interesting circumstance took place. I had among my students at Boston University a young Japanese student named Tsawa. He came to me for the purpose of studying the pronunciation of English. Of course, when he heard about the telephone he became very much interested. He said: "Mr. Bell, will this thing talk Japanese?" I said: "Certainly, any language." He seemed very much astonished at that, and said he would like to try it. I said that he could try it, and he went to one end of the circuit and I stood at the other. He talked Japanese, and I reported the result to him. He asked if it talked Japanese. I said: "It talked Japanese, but I couldn't quite understand it." He was

not quite satisfied with that, and asked permission to bring some Japanese friends of his from Harvard College. I said: "Certainly." He brought two young men there, and they talked through the telephone and listened; so that Japanese was the first foreign language that was spoken over the telephone.

And these two Japanese gentlemen were exceptional men. I did not know who they were at the time, but years afterwards it was revealed to me. I was in Japan, in Yokohama, when the American residents in Japan were giving a banquet to the new Japanese Minister who was going to Washington, Mr. Kamura, now at the head of affairs in Japan. I was asked to attend the banquet, and instead of being introduced to Mr. Kamura, he came up to me and said: "I don't require an introduction to Mr. Bell. I knew him years ago." And he turned out to be one of the Japanese students. Then I found out about the other one in a rather curious way. The Japanese government sent to this country at the time of the Russian-Japan war, Baron Kaneko. He came to Washington and gave a lecture before the National Geographical Society. I happened to be president of that society at the time. And so when the dinner was over and the time for speaking came, Baron Kaneko said: "I knew Mr. Bell years ago," and he told his story about the use of the telephone. So those two men, the foremost men in Japan today, Baron Kaneko and Mr. Kamura, were the two men who heard the telephone in the winter of 1876-1877.



Tower Lights of Girard College

Girard College, located on Girard Avenue, is one of the particular points of interest in the city of Philadelphia. It was founded by Stephen Girard and the first 100 pupils were admitted in 1848. The bequest was left to the city of Philadelphia, as trustee, for the education of poor white male orphans from Pennsylvania, New York City and the city of New Orleans.

A peculiar feature of the provisions of endowment was that no clergyman

GIRARD COLLEGE GROUNDS AND ONE OF THE TOWER LIGHTS

should be allowed to enter the grounds. This restriction was made by Girard, it is said, not from any feeling of hostility against the profession, but in order to prevent the minds of the young orphans from being subjected to the strife of sectarian controversy.

The grounds of the college embrace 40 acres and are surrounded by a stone wall ten feet in height. Electric energy for supplying the lights and motors driving the various shops and laundries throughout the grounds is generated in a power house located in the western end of the enclosure.

The plant is operated 24 hours a day under the direction of the chief engineer, who has charge of all the engineering work of the college. The operating force consists of two engineers, eight firemen, one electrician and one trimmer.

A tunnel running from the power house for a distance of about three-quarters of a mile carries all the wiring, steam and hot water pipes for the laundry and other purposes. Branches leave the tunnel at various points for supplying the different buildings.

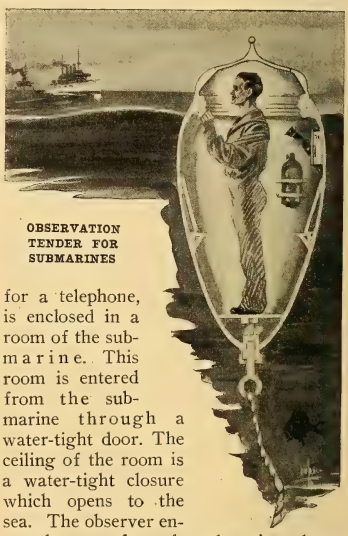
Decidedly the most novel feature of the installation is the illumination of the ground by use of Westinghouse metallic flame arc lamps mounted on steel towers. These towers are 130 feet in height and there are seven of them distributed throughout the grounds. Each tower has six lamps mounted at the top. Steps are provided on the frame work of the tower to enable the trimmer to reach the lamps.

A telephone subscriber in Athens, Ohio, requested the operator to "ring the bell" every 30 minutes from three p. m. until the next morning. Upon investigation the subscriber explained that the baby was dangerously ill and, as the house clock was not in working order, requested the calls for the purpose of giving the baby the medicine at regular intervals as prescribed by the physician. Surely the telephone is a "jack of all trades."

Observation Tender for Submarines

A New Jersey inventor, Stanley Pontiere, Ocean City, has received a patent upon a means of leaving a submerged submarine and of using the same device to observe the movements of vessels.

The egg-shaped buoy of a size to permit a person to stand erect, and to provide



OBSERVATION TENDER FOR SUBMARINES

for a telephone, is enclosed in a room of the submarine. This room is entered from the submarine through a water-tight door. The ceiling of the room is a water-tight closure which opens to the sea. The observer enters the room from the submarine, closes the door, then gets into the buoy through the top, which is now securely fastened down. The buoy is then set free by opening the door to the sea, and controlled by a windlass in the room. This windlass is operated by shafting through water-tight bearings through the walls from the adjoining room. Windows in the cover of the buoy permit observations as soon as the buoy reaches the surface and the telephone connected by water-proof cable to the submarine is used to transmit information regarding the movement of vessels on the surface. A tank of compressed oxygen keeps the air pure.

Electric Photography

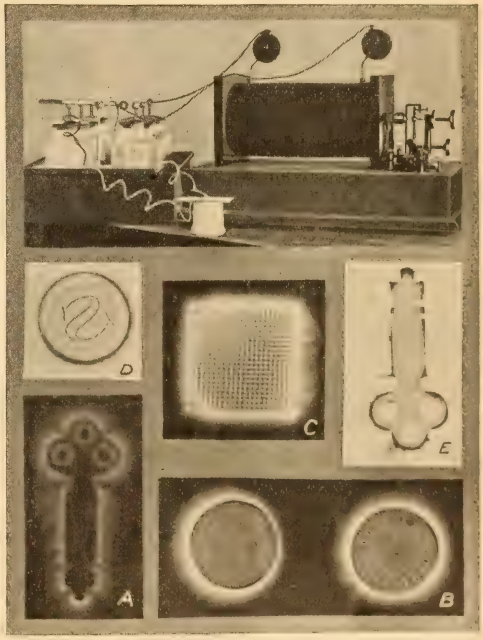
The accompanying illustrations are examples of photographic reproduction by means of electric photography. The process is, of course, only applicable to photography of inanimate objects because, under the disconcerting influence of a high voltage, animate beings would hardly be able to respond cheerfully to the usual "Look pleasant, please!"

The terminals of an induction coil or an electrostatic machine are connected to the terminals of a condenser which may consist of a few Leyden jars. A photographic plate with its sensitized surface uppermost is placed over a smaller sheet of tinfoil which rests upon an insulator. Upon the plate is placed the metallic object whose facsimile is desired. The terminals of the condenser are connected to the metallic object and the tinfoil sheet, respectively. The object is highly charged for an instant and on developing the negative a reproduction of the object is obtained.

The process is preferably carried out in a dark room. However, it can be done in a light room with the plate properly protected from exposure to light. The objects (A), (B) and (C) were reproduced from exposed photographic plates while (D) and (E) show the effect of using photographic printing paper instead of the sensitized plates. In the first three illustrations the lighter parts represent raised portions on the object reproduced while these parts are shown in the darker parts of the last two illustrations. A variation of this experiment is found in substituting a plain glass for the photographic plate. If the metallic object is charged for a long time by means of an electrostatic machine, on removing the object and breathing on the spot the image of the object will be seen.

Telephones in Tripoli

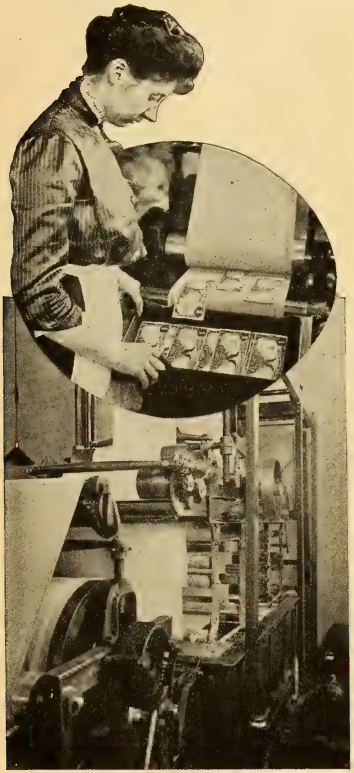
The city of Tripoli, with a population of 40,000, has the only telephone exchange in the entire country of Tripoli, the seat of the present war. It has seven stations, and has always been operated by the military department of the Turkish government.



APPARATUS FOR ELECTRIC PHOTOGRAPHY AND SOME EXAMPLES OF WORK

The Perfected Money Laundering Machines

After three years of experiment and research the experts in the United States Treasury Department have finally perfected practical, electrically operated machines for laundering currency. While the idea of washing money is very old, this present achievement constitutes the first solution of the problem of laundering bank notes on a commercial scale. It will put in circulation in all parts of the country a vastly increased proportion of clean, sanitary currency, replacing the literally "tainted" money which is so unsightly to look upon and (presumably) unhealthy to handle.



LAUNDERING MONEY IN THE U. S. TREASURY

These newly devised machines for washing and ironing our paper money will be installed not only at the Treasury at Washington but at all the Sub-Treasuries throughout the country and at all those banks whose directors find it more economical to operate a money cleaning plant of their own than to ship soiled banknotes by express to Washington to be replaced by new, as is at present the plan. Even foreign nations are planning to make use of Uncle Sam's novelty. The German government recently sent over some paper money to be rejuvenated by the newly invented machines and when it was sent home the Teutons pronounced the ink brighter than when the notes were freshly printed.

The perfected, money washing machine is twelve feet in length, eight feet in height and 2½ feet in width and is operated by a one-fourth horsepower electric motor. In this machine the bill to be cleaned is received between two endless bands of the finest cotton duck nearly 60 feet in length, the function of which is to hold the bill flat while it is washed or scrubbed by passing back and forth over peculiarly shaped rollers. In the washing process liberal use is made of a special soap that has been developed by Uncle Sam's chemists and each bill is further bleached and sterilized by chemicals that liberate ozone when dissolved in hot water. It is claimed that the most virulent disease germs instantly succumb to this treatment and all organic matter that would serve as a breeding place for germs is removed.

After a bill has passed back and forth in the washing tank it is similarly shifted in a rinsing tank and then as it emerges from the latter is removed by a jet of air to another endless band of duck that passes over two gas heated drums where it is dried as flat and smooth as a new bill.

It requires just 2½ minutes for a banknote to be washed and dried, but the capacity of the machine is only limited by the dexterity of the operator. The cost of operation is estimated to be not more than 20 cents per thousand bills. Following the washing operation comes the sizing and ironing, which is performed by another remarkable machine—likewise just invented—which is operated by a ⅜ horsepower motor. In the ironing process the bills are first passed on a duck apron over heated drums and are then delivered to compressed paper drums which iron them.

Gray Squirrels Gnaw Cables.

The fact that Ann Arbor, Mich., the home of the State University, is a city where trees adorn both the streets and yards, makes it a squirrel's paradise. A city ordinance protects the little animals and good treatment has apparently made

By Courtesy of the Chicago Telephone Co.

A COMMON SOURCE OF CABLE TROUBLE IN ANN ARBOR

them bold, according to accounts from the telephone company to whom they are giving trouble.

From the trees and by way of the poles the squirrels have ready access to the telephone wires and cables. Their greatest offense consists in gnawing into the lead armor of the cable, as shown in the accompanying illustration.

Pottery Designs for Lamp Bases

Molded clay supports for table, dresser or mantel electric lamps are gradually finding favor. The reason suggested for

POTTERY DESIGNS FOR LAMP BASES

this innovation is that the masses of earth, as they come from the potter's hands, express the fancies of his imagination and offer a sort of human appeal.

Four lines from Omar Khayyam, the Persian poet, bring out this thought:

"Shapes of all sorts and sizes, great and small,
That stood along the floor and by the wall;
And some loquacious vessels were; and some
Listen'd perhaps, but never talk'd at all."

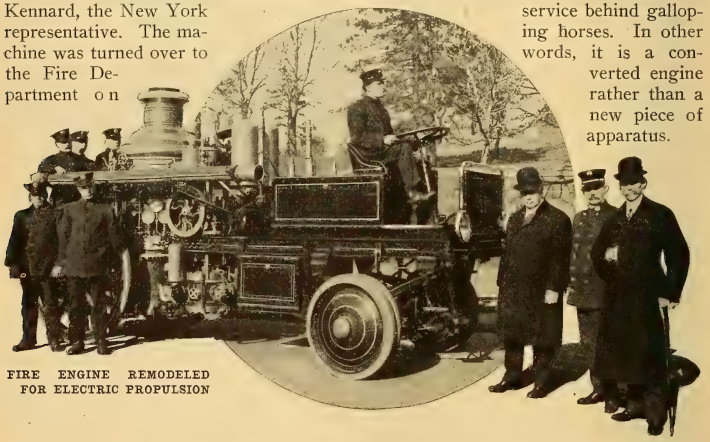
The accompanying illustration shows several designs of Teco pottery for lamp bases.

It is asserted upon good authority that Twin Falls, Idaho, uses more electricity for heating and cooking in proportion to its population than any other city in the world. A large office building which has recently been erected is entirely heated by electricity.

Remodeling Fire Engines for Electric Propulsion

The latest piece of apparatus installed by the New York Fire Department, and one that is attracting attention not only in the city but throughout the country, is a pumping engine propelled entirely by electric power, although its pumping apparatus is the standard steam type that has been in service in the department for years.

It was constructed by the Couple-Gear Company of New York, in a wagon shop in the Bronx, under the direction of J. H. Kennard, the New York representative. The machine was turned over to the Fire Department on April 16 and after a week's trial was placed in actual service on the 24th. It is stationed at the house of Engine Company 117, Dekalb near Lewis avenue, Brooklyn, and has given excellent service in the short time it has been there.



FIRE ENGINE REMODELED FOR ELECTRIC PROPULSION

The first official test was held a few days after the engine had been turned over to the city. A six mile run was made through the streets of Brooklyn, and the actual running time was 23 minutes, including the time of delays at street car crossings and the slow progress made in Brownsville, a crowded tenement district. Over some parts of the distance, where the roads were clear, a speed of 20 miles was attained.

The engine was placed in commission on Wednesday, the 24th, and almost as soon as it had been backed into place it was called to a fire a mile away. The run was made in about three minutes.

The Couple-Gear engine is different from anything in the way of motor vehicles and has been devised for fire fighting purposes. Primarily it is propelled by electric motors, contained within the wheels. In addition to this, the pumping apparatus is a regular fire department engine that has seen months of service behind galloping horses. In other words, it is a converted engine rather than a new piece of apparatus.

If this apparatus meets the requirements of the department or fulfills the promises of the builders, it will prove the solution of the problem that now confronts the committee that is investigating various types of motor apparatus. There are now in the city service about 200 steamers. They represent the highest development of the steam pumping engine and are as nearly perfect as can be. They cost approximately $6,000 each. Every engine is good for many years of service. To replace them with new automobile engines would mean an expenditure of millions of dollars.

Safeguarding the Lives of Little Children

A remarkably efficient work is being done by the Portland (Ore.) Railway, Light and Power Company in the matter of prevention of accidents to little school children. The work is carried out in the form of lectures to the children themselves, rather than to the parents, and has been going on for over two years. This year lectures have been delivered daily at the various public schools by C. H. S. King.

B. F. Boynton, claim agent of the company, who has charge of this work, writes as follows:

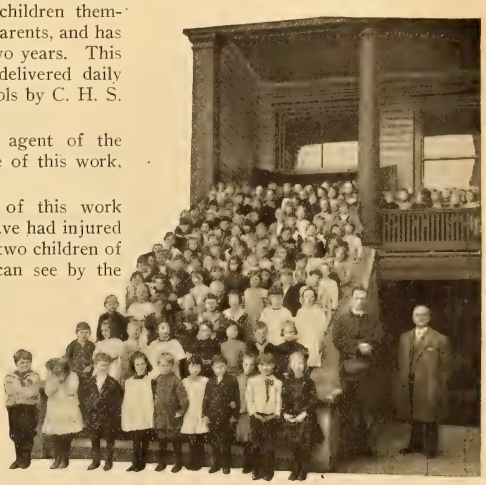
"Since the taking up of this work through our schools we have had injured through car accidents but two children of school age, so that you can see by the results obtained whether this has been money well spent. I am satisfied that we have not only saved the lives and limbs of numerous little ones, but that they have spread the good work and helped save the lives of older people.

"Mr. King, in his addresses to the children on the prevention of accidents, does not confine himself to cars alone, but takes up the general line of accidents children are subject to in coming from and going to school, telling them to be careful at all times in approaching all streets and highways; to be constantly on the lookout for cars, automobiles and vehicles of all descriptions. As this is a day and time when the keynote to success on the accident line is 'Prevention,' I feel that there is nothing in the world that can be done in our great broad land that will tend more to prevent accidents than by educating our little ones along that line carefully.

"This work we expect to continue permanently."

The work does not stop with the education of the children but is extended to the train service men—the motormen and conductors. Mr. Boynton says in this regard:

"Every new man, before he can be turned in and handle his car himself, either as motorman or conductor, must



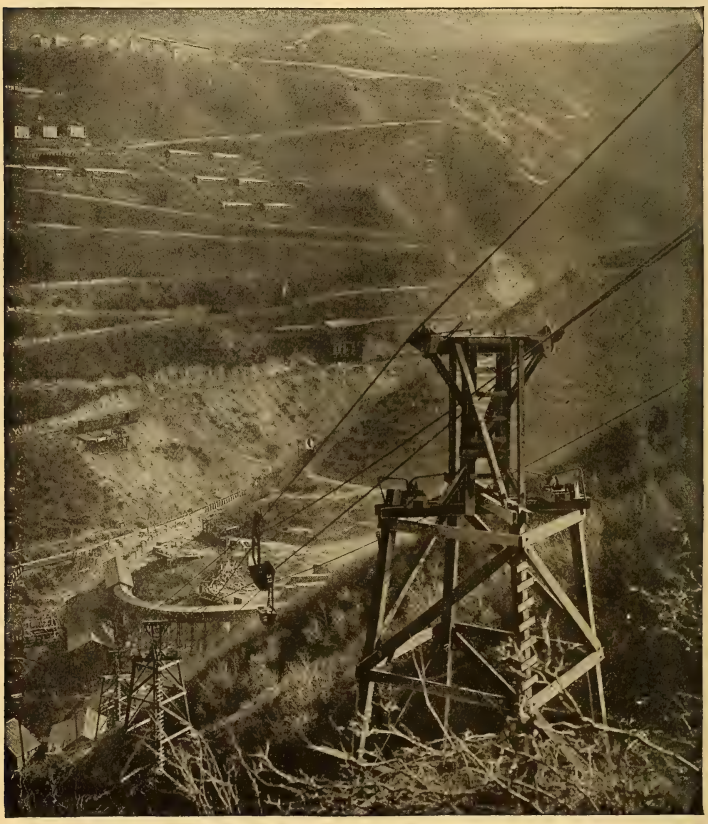
PORTLAND SCHOOL CHILDREN WHO ARE BEING INSTRUCTED IN THE PREVENTION OF ACCIDENTS

attend one of these schools of instruction, and every old man must attend one once every six months. The idea of bringing the old men in every six months is to keep the matter before them so that they will not get rusty, and it has proved very satisfactory.

"It may be said that this matter of the instruction of trainmen has been in vogue for the past five years, and at the time we started this school of instruction we were having as many accidents as we are having today and we are now carrying more than double the number of people and operating double the number of cars, so that you may figure for yourself whether we have gained results by so doing."

Aerial Trams of a Utah Mine

This view shows the workings of the Highland Boy mine of the Utah Consolidated Mining Company, Bingham, Utah. Among other equipment is an aerial tramway system four miles long for bringing ore down the mountain side. The loaded tram or bucket travels down the aerial cable by gravity and, through the cable which holds it from traveling too fast, drives at the same time a 100-horsepower motor which acts as a regenerative brake. In other words this motor, when the loaded bucket is traveling downward, acts as a generator or dynamo and delivers current to a transmission line, and the energy of gravity is thus saved to do useful work. At any time when the weight of the downgoing tram may

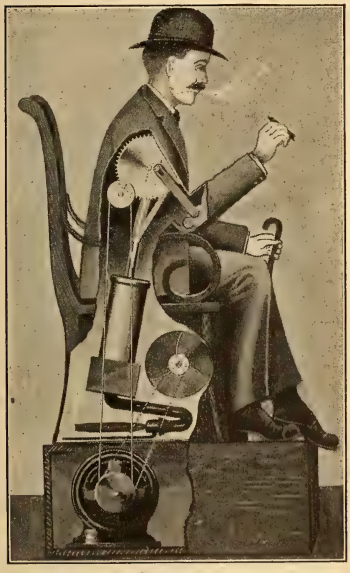


AERIAL TRAMWAY OF THE HIGHLAND BOY MINE, BINGHAM, UTAH

not be sufficient to draw the empty ones upward the motor performs its usual function and applies mechanical power to the cable, thus, in a pinch, helping gravity to do its work.

Demonstrating a Cigar

An electrically operated figure and its mechanism for demonstrating the pleasures of smoking a cigar is the subject of a patent issued to Harry E. Coates, Sacramento, Cal. A suction holder for a cigar, a piston for drawing

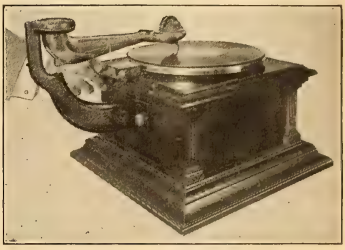


UNIQUE CIGAR DEMONSTRATION MACHINE

in the smoke and expelling it through a tube connected to the mouth of the figure, and a geared mechanism for imparting motion to the arm, are the main features of the invention. The actions of the mannikin are supposed to be very realistic as he raises the cigar to his lips, takes a whiff and slowly expels the smoke.

Phonograph with Electric Brake

Electricity adds to the enjoyment of the phonograph, removing the annoyance which every owner of a talking machine knows, of racing to the machine and stopping it at the close of each selection in order to prevent the unpleasant scratching of the needle. A tiny brake



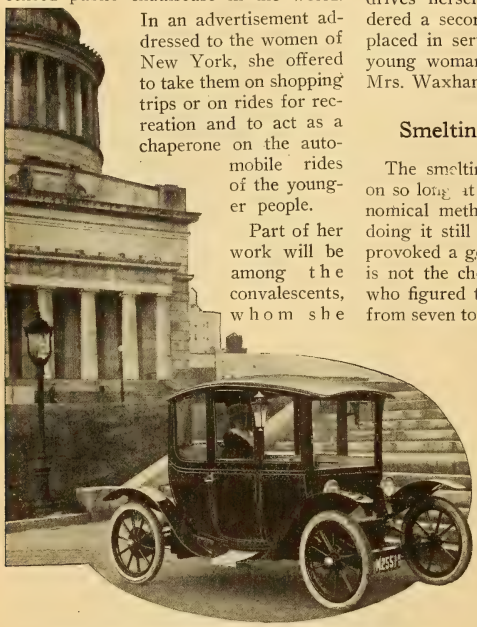
PHONOGRAPH WITH ELECTRIC BRAKE

has recently been devised by a Los Angeles inventor which operates automatically, stopping the record at the close of the piece and allowing the listener to receive full benefit from the selection without being prepared to jump out of his chair and run for the machine as each record draws to a close.

The attachment is enclosed in a small metal case of less than two inches in length and breadth and of less than half an inch thickness. The electrical energy is derived from an ordinary dry cell, which may be set in any convenient place and wired to the brake. The latter is attached to the phonograph in an inconspicuous position. In operating the device, the record is placed in position and the arm of the phonograph (which holds the needle) is brought to the last thread of the disk. This brings it in contact with a movable upright lever. Then the arm is brought back to the beginning of the record and a spring is pressed which sets the brake ready for action. When the record has been played, the arm is once more in contact with the upright lever, which contact closes the circuit and automatically throws on the brake.

The Arrival of the Chauffeuse

College woman, medical student, chauffeuse and chaperone are a few of the claims to distinction of Mrs. Alice E. Waxham, of 2 West Ninety-fourth Street, New York, who recently entered the automobile business as the only licensed public chauffeuse in the world.



FIRST NEW YORK CHAUFFEUSE IN HER ELECTRIC AUTO

In an advertisement addressed to the women of New York, she offered to take them on shopping trips or on rides for recreation and to act as a chaperone on the automobile rides of the younger people.

Part of her work will be among the convalescents, whom she will take for recreational rides. For this reason a low swung electric coupe is used. The electric was selected because it is clean and noiseless, and therefore does not try the nerves of delicate persons. Its easy control commended it for use in the crowded shopping districts.

Mrs. Waxham has driven cars, both gasoline and electric, for many years. In fact she was the first woman of Denver to drive her own automobile. There, long tours among the mountains, with breakdowns in lonely places, made her thoroughly familiar not only with the driver's work, but with the mechanical construction of the car. She came to New York five years ago and last winter decided to take up this unique occupation.

Starting in with one car which she drives herself, Mrs. Waxham has ordered a second machine. When this is placed in service it will be driven by a young woman who was a classmate of Mrs. Waxham at Wellesley College.

Smelting Tin at Cornwall

The smelting of tin has been carried on so long at Cornwall and by such economical methods that the suggestion of doing it still cheaper electrically at first provoked a general smile. However, tin is not the cheapest of metals and those who figured the costs closely found that from seven to nine per cent of the tin was always lost under the old methods by volatilization and in the slags. To get this loss down to a lower point, the flue dust had to be condensed so as to save some of the metal which had been vaporized. This has always proven a costly and troublesome operation. Besides, the smelting furnace had to be shut down after each charge and allowed to cool, thereby wasting a good deal of the heat of the fuel.

On the other hand, an electric furnace can be operated both day and night and as the furnace is kept closed, the loss by vaporizing is practically eliminated. Tests recently made at Cornwall on a furnace capable of handling ten tons of ore per day showed that the loss of tin could be reduced to about one per cent. The cost of labor and repairs was greatly reduced, and tests showed the electric furnace could be run continuously for months.

Lighting Effects Past and Present

One hears a great deal these days about illumination and lighting units. It is interesting to note how little we have changed our ideas from those held by the Old Romans in the days of Pompeii, as to what constitutes a pleasing effect in diffused illumination.

A noted scientist, on returning from Europe recently, reported having seen in an old Roman cathedral thin slabs of marble used in the place of window glass in order to obtain a soft, diffused light from the brilliant sun light of the famed Italian skies. This effect was impossible with artificial light, owing to the insignificant candle power of the oil lamp,

TYPE OF OLD ROMAN OIL LAMP

of which the cut illustrates a common type.

Today we are striving after the same effect in artificial illumination by enclosing a high candle power metallic filament electric lamp in a diffusing bowl. The accompanying cut shows a sixteen inch Haskins Lucida glass ball inside of which is used a 400 candle-power Mazda lamp. The unit emits an easy, soft, diffused light with a surprisingly small amount of absorption and produces an effect not unlike that obtained with the marble windows in the days of Pompeii.

MODERN LIGHTING UNIT GIVING THE EFFECT OF THE OLD TIME MARBLE WINDOW SLAB

German Sidewalk Signs

A somewhat novel advertising scheme is being introduced in some of the German cities. In the sidewalk is inserted a plate of heavy glass of the kind which is used for giving light to basements or the like, and under the glass are electric lamps which light up an advertising sign placed upon a second glass or on the under side of the heavy glass plate. This latter need not be of very large size and can show up an object such as a shoe, or spectacles, for instance, and with an arrow pointing to the store near by. Quite a number of novel effects can be produced by mounting an illuminated sign in this way, and it is sure to attract the eye of the passers-by to the walk, being in this way even more effective than a sign placed overhead.

Head Lights for Victims of Night Shipwrecks

A new life preserver to aid in rescue work in case of a shipwreck at night has been successfully tested by the German Navy. The apparatus, which weighs 5½ pounds, consists of two swimming cushions bound together by straps. The cushions lie upon the breast and back. The apparatus is provided with a small lamp fed by a battery. The lamp is fastened around the head with a band worn on the forehead, so that in an accident at night the position of the person in the water can be seen at a considerable distance. The small electric lamp burns three to four hours and with a reflector added throws the light several hundred yards at night. In several recent tests of life saving at night the victims of the supposed shipwreck, by aid of the lamp, have been easily discovered. The life preserver can be buckled around the body in five seconds. The lamp begins to shine as soon as the buckles are fastened.

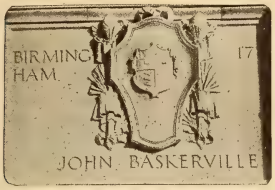
ELECTRIC HEADLIGHTS IN LIFE SAVING

Immense Electrification Project for Berlin

A report was lately presented by the German Minister of Public Works on the proposed plan of adopting electric trains on the extensive systems of the Berlin City, King and suburban railroads. The report was presented as a foundation for a bill which it is hoped to pass. There is all the more likelihood that electric traction will be favored since the present system is now run at a loss of over $5,000,000 a year. The proposed electric trains will be made up of twelve passenger cars or less, with two locomotives at the ends, without using any motor cars. To carry out the scheme there will be used no less than 557 electric locomotives as well as 690 passenger cars. Power for operating all the lines will come from two new 150,000 horsepower steam operated electric stations. The cost of the scheme, not counting the electric stations, will be $30,000,000. For the electric plants, feeders and substations the estimate is $22,500,000.

The Carving of Stone Tablets

The exterior of the new central building of the St. Louis Public Library pre-



sents some interesting features in the way of ornamental accessories. Beneath each large window of the main story the trade-marks of the old printers are carved upon tablets of stone beginning with Gutenberg, Fust and Schoeffer. William Caxton's trade-mark is found on tablet three, Benjamin Franklin and Christopher Saur occupy tablet 27, John

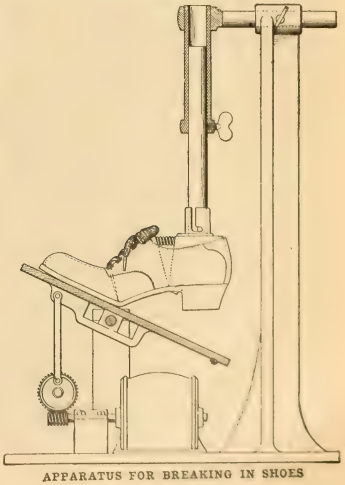
MODERN STONE CARVER AT WORK

Baskerville's mark is on tablet 28, while William Morris is on tablet 30. These old trade-marks represent important historical trade truths and illustrate the progress and gradual evolution of printing as each trade-mark stands for a man who advanced the art of printing.

The carving of the thirty tablets on the St. Louis Public Library, as well as the inscription of the great literary names was done with the three-quarter inch "Keller" pneumatic carving tool, which is used for carving, lettering and chasing on granite, marble and other stone. This tool consumes about six cubic feet of free air per minute. All the work was done with an air compressor electrically driven. The workmen guide the carving tools but the compressed air and electricity do the work.

Apparatus for Breaking In Shoes

We shall doubtless be spared the sometimes painful operation of "breaking in" new shoes. Clarence P. Byrnes, Sewickley, Pa., has received a patent upon a device to do this. A last is inserted in the shoe and fastened to the machine as shown. A small electric motor operates a worm gear which moves an oscillating platform under the shoe, flexing it and giving it a motion somewhat similar to the action in walking.



APPARATUS FOR BREAKING IN SHOES

The Cameragraph

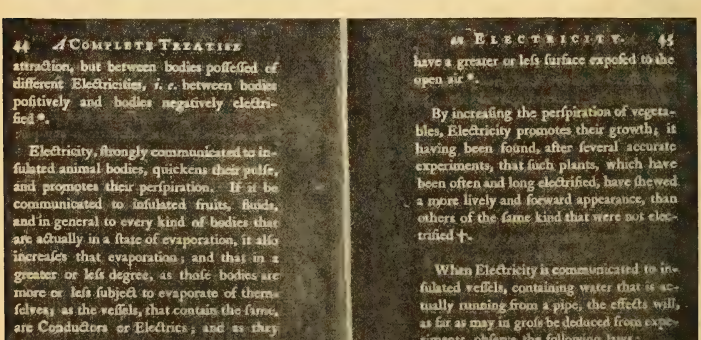
The John Crerar Library, Chicago, where many rare and valuable books—too valuable to permit of their removal from the reference rooms—are kept, has placed at the disposal of its patrons the Cameragraph, a new invention for photographing the pages of any book or document.

The equipment, as used at the library, consists of a copyholder, a camera and two mercury arc lamps. The lamps are not required where proper light is available.

The copyholder, which resembles a small stand with a central support, is provided with two rods under which and upon a black background is placed the open book to be copied. The stand top is then shifted into a vertical position facing the camera. Focusing the lenses and arranging for the size of the picture are both accomplished by adjusting with a crank the copyholder and lenses according to a table referring to scales laid off under each.

The blue-white light of the mercury arc lamps is now turned upon the page, the operator presses the bulb for opening the shutter and the exposure is made upon photographers' print paper instead of upon a plate or film. Within the cameragraph is 100 yards of this print paper. The interior mechanism is so arranged that after the exposure is made the operator turns a crank which draws the printed paper into a developing bath. In 30 seconds the crank is turned in the opposite direction, which removes it from the bath. A lever is now pressed, cutting off the print, which drops into a fixing bath. A plunger is then operated, which pushes the print under the surface of the fixing bath. The cover is now opened, the print taken out and washed in pure water.

Pages are photographed from any book



44 A COMPLETE TREATISE

attraction, but between bodies poſſeſſed of different Electricities, *i. e.* between bodies poſitively and bodies negatively electrified *.

Electricity, ſtrongly communicated to inſulated animal bodies, quickens their pulſe, and promotes their perſpiration. If it be communicated to inſulated fruits, fluids, and in general to every kind of bodies that are actually in a ſtate of evaporation, it alſo increaſes that evaporation; and that in a greater or leſs degree, as thoſe bodies are more or leſs ſubject to evaporate of themſelves; as the veſſels, that contain the ſame, are Conductors or Electrics; and as they

* This law, *i. e.* that there is no electric attraction, except between bodies poſſeſſed of different Electricities, will, perhaps, appear paradoxical, upon obſerving, that an excited Electric attracts ſmall bodies, which never were by any means made electrical before; but the paradox will ceaſe wholly, if what has been ſaid above be conſidered, *i. e.* that when Conductors, and indeed Electrics too, come near an electrified body, they become actually poſſeſſed of a different Electricity. But this will appear much clearer from the experiments that are to be communicated hereafter.

have

ELECTRICITY. 45

have a greater or leſs ſurface expoſed to the open air *.

By increaſing the perſpiration of vegetables, Electricity promotes their growth; it having been found, after ſeveral accurate experiments, that ſuch plants, which have been often and long electrified, have ſhewed a more lively and forward appearance, than others of the ſame kind that were not electrified †.

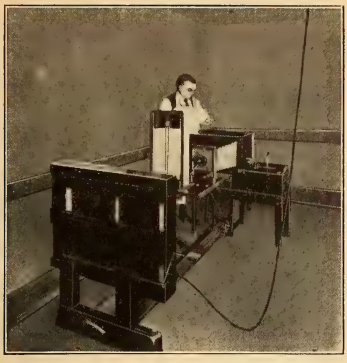
When Electricity is communicated to inſulated veſſels, containing water that is actually running from a pipe, the effects will, as far as may in groſs be deduced from experiments, obſerve the following laws:

* Although it has been by ſome pretended, that Electricity cauſed ſeveral ſubſtances to evaporate through the pores of glaſs and metals, yet this could never be obſerved, though many accurate experiments were made for that purpoſe: beſides, this pretended evaporation ſeems on all accounts exceedingly improbable.

† It is ſaid by Mr. KORTHOLT to have been found, that negative electrization retards both animal and vegetable life.—See his Latin Diſſertation on the effects of Electricity upon ſome organic bodies.

1. The

PHOTOGRAPH OF TWO PAGES FROM A BOOK PRINTED IN 1795



THE CAMERAGRAPH

in the library, a charge of fifteen cents a print being made. The accompanying picture is a photograph from "A Complete Treatise on Electricity. By Tiberius Cuvalls, F. R. S. Printed in London in 1795."

Trinity's Electric Sign

With the development of the institutional features of Trinity Parish House, the Reverend John H. McGann, rector of Trinity Episcopal Church, Chicago, found himself in a peculiar situation. The Parish House, a beautiful Gothic stone structure, stands adjoining Trinity Church on Twenty-sixth Street at Michigan Boulevard, in what was a decade ago the most exclusive residence district in Chicago. Within a few blocks were the mansions of the city's most famous and influential residents and among Trinity's parishioners are many families prominent in the development and fame of Chicago.

At its best, Twenty-sixth Street is poorly illuminated by the few lamp posts that did duty when it was a quiet residence side street. The location of the Parish House almost required a chart and compass after dark, certainly it did not attract or invite anyone to its doorway. Light was needed and the idea of employing an electric sign to mark the entrance was evolved. The problem of designing and erecting such a sign was submitted to the Federal Sign System (electric) for solution.

Photographs of the building were submitted to architects Lowe and Bollenbacher, who prepared a design, the simple Gothic dignity of which blended in architectural detail with the building, and yet did not lose its force and legibility so necessary in an electric sign. The sign itself was then cast in solid metal from moulds made from the architects' drawings. The faces of the raised Gothic letters and of the cross, which measures two feet high, were made of white porcelain enameled steel. At each end the words "Parish" and "House" in milk white leaded art glass upon an amber background were illuminated from the interior and blend in pleasing harmony with the bronze surface of the sign. Massive bronze chains and square bronze rods support the sign, necessitating the piercing of the stone wall two feet thick for a secure anchorage.

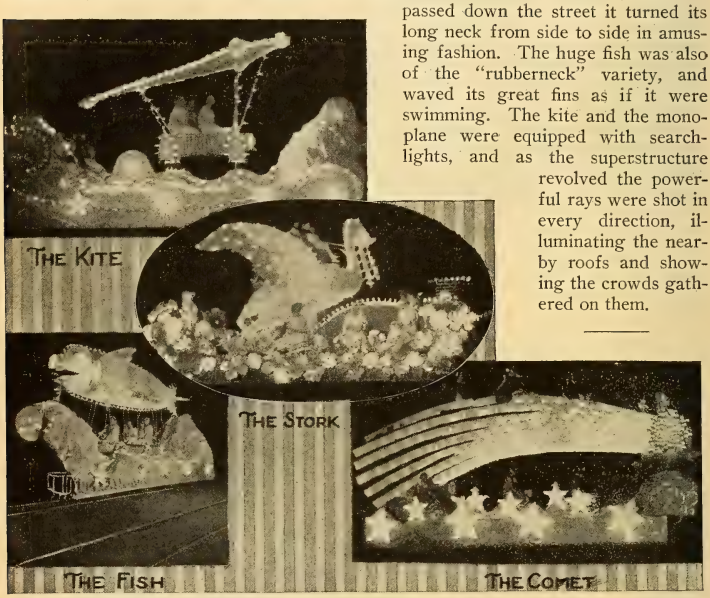
Frosted carbon lamps of 180 candlepower illuminate the letters.

TRINITY'S ELECTRIC SIGN

Electric Parade for the Shriners

Los Angeles provided lavish entertainment for the Shriners, who held their National Conclave in that city last May, and of all the pleasures offered the guests, the electric night parade was undoubtedly the choicest. Fifteen floats formed the pageant, accompanied by a dozen bands and patrols of gaily uniformed nobles. The floats were built upon flat cars, operated by an overhead trolley, from which they received their light and power. The motormen were concealed under the body of the float in every case, so that the fairy-like creations appeared to move slowly through the streets under their own power. Thousands of incandescent bulbs of all colors were used to outline the designs of the floats, which were strikingly original.

Among the finest of the lot were the Monoplane, Stork, Fish and Comet. The latter was operated by a flasher so that the light in the head of the comet remained steady, while the long tail rippled with flashes of light. The stork was carried on a float full of children, and as it passed down the street it turned its long neck from side to side in amusing fashion. The huge fish was also of the "rubberneck" variety, and waved its great fins as if it were swimming. The kite and the monoplane were equipped with searchlights, and as the superstructure revolved the powerful rays were shot in every direction, illuminating the nearby roofs and showing the crowds gathered on them.



SOME FEATURES OF THE SHRINERS' PARADE IN LOS ANGELES

Germany's Long Distance Wireless Operations

One of the newest of the German wireless stations is now opened at Swakopmund, and it has a 300 foot tower for the antenna. It is intended largely for use in signaling to vessels, and is trying some new apparatus in connection with the vessels, one of these being the steamer "Windhuk," and with it the post is sending messages 1200 miles out to sea. The "Admiral" of the East Africa line is also engaged in the experiments.

Electricity in Embroidery Designing

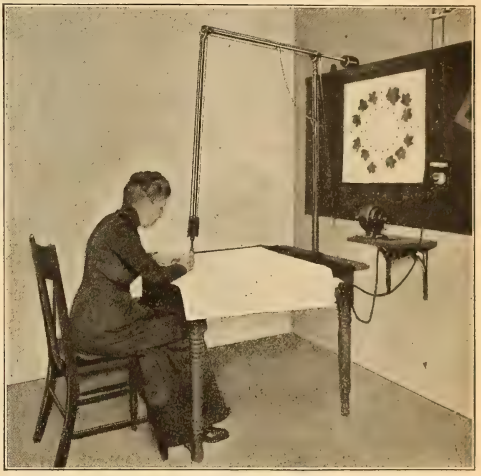
The acquirement of beautiful embroidery work, such as pillow tops, doilies and a score of other fanciful creations in which every woman delights, is not at all difficult with the patterns now purchasable at department and dry goods stores. Indeed, there are small stores entirely devoted to the teaching of art needlework and the sales of supplies needed.

With the growing demand for needlework patterns, it is quite to be expected that the tracing of patterns with carbon paper should be followed by a more rapid and satisfactory method, and in this improvement electricity does the work.

The illustration is a picture taken in one of Chicago's embroidery establishments. The table and arrangement of the electrical equipment were made und direction of Mrs. Wm. F. Graves, one of the firm, who is seated at the table. From a speed pulley on the electric motor a strong thread drive runs out along the balanced arm, then down to mechanism in the metal enclosure just above the hand of the operator. This mechanism run by the thread drive causes the needle to move up and down many hundred times a minute.

An appropriate design is first made in pencil upon a single sheet of white paper, which is then laid upon the table over frequently as many as 20 sheets of like size. The needle is now directed along the pencil outline, perforating every sheet of paper as it goes, giving 20 similar patterns. These patterns are now used to place the design upon cloth or canvas by laying one of the sheets upon the canvas and applying a color brush, thus leaving a tracing of needle point lines.

By speeding up the needle it may be made to cut out of stencil board the figures of leaves, fruit, etc. The stencil may then be placed upon canvas or cloth and with brushes the proper colors are applied through the openings in the stencil. Upon the wall in the picture is displayed a pillow cover prepared in this way and ready for the design to be worked out with the needle.



ELECTRICAL DEVICE FOR MAKING EMBROIDERY PATTERNS.

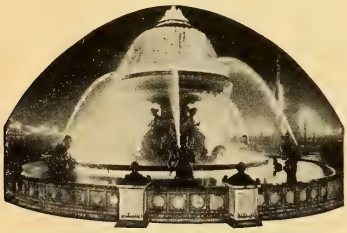
Longest Nickel Street Car Ride

Chicago now furnishes the longest five cent car ride in the world—a through route car running from One Hundred and Nineteenth Street, the southern limits of the city, to Howard Avenue in Rogers Park, on the north side, a distance of 28 miles. Any patron who thinks he does not receive the worth of his nickel can transfer and ride a few more miles farther if he so desires.

Promptness of American and English Telephone Operators Compared

We are prone to look upon time, when waiting, as longer than usual and this is nowhere more evident than when using the telephone. Careful observations show the telephone operator to be quick and efficient. At the annual dinner of the London Chamber of Commerce, according to the *London Electrician*, the postmaster-general stated that during the last six months observations were made upon 50,000 telephone calls, and it was found that the time taken for a call, starting from the time of ringing up to the time of the operator answering the call was on the average 5.1 seconds. The time needed for making the whole connection was 28.6 seconds, or less than half a minute. This is to be taken as a good record in the way of quick working.

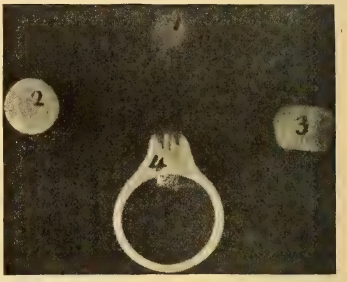
A similar record covering 55,262 calls as made in Chicago over the lines of the Chicago Telephone Company during 1911 give the average time taken for a call starting from the time of signaling for the operator to the time she answers as 3.1 seconds. The American operator has the best of her English cousin by two seconds. The time necessary for the Chicago operator to make the whole connection, which includes the time up to the moment the subscriber answers, was 25.4 seconds.



ELECTRIC ILLUMINATIONS OF ONE OF THE LARGE FOUNTAINS IN THE PLACE DE LA CONCORDE, PARIS

X-rays in Testing Precious Stones

A possible use of the X-rays to the jeweller and dealer in precious stones is for detecting imitations. The photograph herewith reproduced shows that a real diamond is practically transparent to the



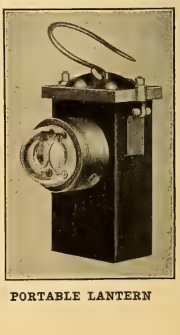
X-RAY PICTURES OF PRECIOUS STONES AND IMITATIONS

ray, giving almost no shadow on the plate, while paste and jet are quite opaque. In the picture (1) is the shadow of the diamond, (2) paste and (3) jet. A real diamond in its setting is shown at (4).

Portable Safety Electric Lantern

The substitution of portable electric battery lamps for fuel burning lamps, requiring oxygen for combustion, in mines and places where inflammable gases exist, will no doubt reduce the loss of life.

The Hubbell safety lamp is one of such designed for this purpose. In case a bulb should be broken and the filament exposed a spring cuts off the current.



PORTABLE LANTERN

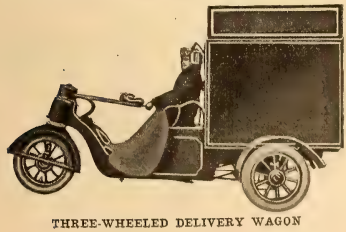
A Swiss Coffee Mill

An electrical firm in Gerlikon, Switzerland, is putting out a small electric coffee mill, very compact in its design and without gears or cumbersome parts. They are constructed in various sizes, from household mills up to large ones for retail groceries, where it is important to be able to grind a large amount of coffee or spices in a short time. The motor is completely incased inside the hopper.

SWISS COFFEE MILL

Three-Wheeled Electric Delivery Wagon

This illustration shows a three-wheeled electric automobile manufactured in Berlin, Germany. The builders desired a machine for light commercial work that would not require too frequent charging of the batteries. The Emilthier will run 90 miles on a single charge and is here shown in service as a delivery wagon.



THREE-WHEELED DELIVERY WAGON

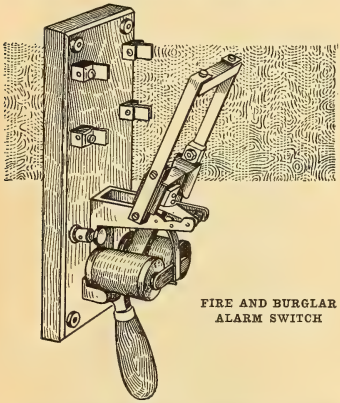
Treadle Controls the Motor

Every year brings less of hard work to be done in the home because electrical devices are doing the drudgery, and in this direction the sewing machine motor has assumed many forms in efforts to rid the task of sewing of the tiresome treadling. The Fidelity motor shown in the illustration makes use of the treadle to start, stop and vary the speed. A chain connects the treadle to a lever extending from the motor by which pressure of the foot is transmitted to the motor control. A base plate is permanently attached to the machine table and the motor may be easily detached when desired.

SEWING MACHINE MOTOR CONTROL

Fire and Burglar Alarm Switch

A switch like this is employed in many fire engine houses to turn on the lights the instant a fire alarm comes in. When connected to the signal apparatus, current is sent through the magnet coils at the first tap of the bell, the locking device releases and the switch closes by the tension of a spring. The switch may also be closed by pressing a push button.



FIRE AND BURGLAR ALARM SWITCH

As a burglar alarm connected to the windows, doors or to a rug containing contacts on the porch it may be made to light in an instant every room in the house. One cell of battery will operate it. The mechanism is finished in nickel plate and polished brass, and is mounted on black enameled slate.

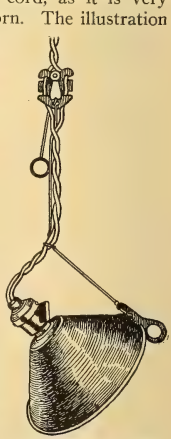
A "Polychrome" Lamp

The new "polychrome" lamp is a convenient little device which photographers will find of use in the dark room. It is designed by a Parisian, Dr. Vincent, and his aim is to have an electric lamp which is easy to operate by a battery of suitable kind, and will give different colored light such as is needed in various operations. On the box containing the battery is mounted a small lamp and reflector, and in front of the lamp can be turned a large disk which has four openings. One opening is left free for the white light of the lamp and the rest have color glasses which are easy to put in place or remove. Turning the disk about we first have the usual red dark room light, then a green light which is also used for developing purposes. The fourth hue can be yellow, for working with bromide paper, or other colors can be used such as colored papers of various kinds. A double glass disk is furnished here so that the paper can be put in and so held flat. This is a lamp which the amateur can easily make for himself.

"POLYCHROME" LAMP

An Approved Lamp Cord Adjuster

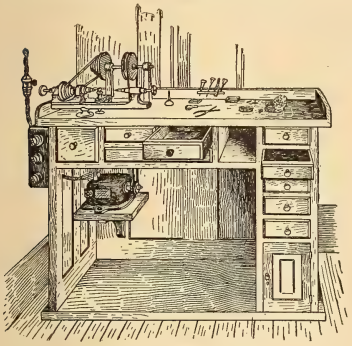
The insurance companies, as a rule, look with disfavor on adjusters used with ordinary lamp cord, as it is very easily frayed and worn. The illustration shows one designed to give the proper adjustment without any abrasive movement of the cord and at the same time provides a means for tilting the shade. A piece of fiber carrying a flat spring strip, under which passes the fish cord to a ring, raises and lowers the lamp. From the point where the fish cord is secured to the lamp cord is an extension carrying a piece of slotted metal, which tilts the shade when light is desired at a point not under the lamp.



LAMP CORD ADJUSTER

Jeweler's Power Motor

The foot wheel of the jeweler and watch repairman is being replaced by the electric motor. The installation of such a motor is here shown. The first of the three switches on the bench starts and

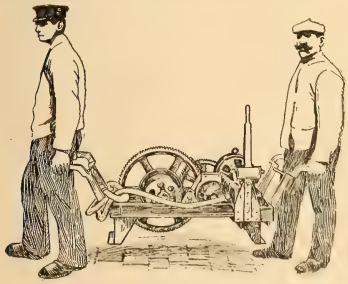


JEWELER'S POWER MOTOR

stops the motor, the second provides for three different speeds and the third instantly reverses the motor, even though it is running.

A Handy Contractor's Hoist

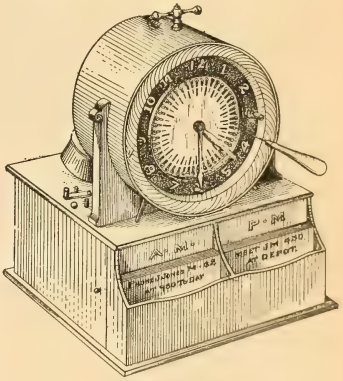
Wherever current is available, an electric hoist is not only economical and easy to operate, but also easy to install. If it is built with convenient handles, two men can readily carry a motor driven hoist ample for raising weights up to 450 pounds. When carried to its new position, four screws are quickly inserted to hold it in place and while one man is inserting them, the other can make the needed connection to the source of current. The same portable form is also a great labor saver in elevators, lofts and other buildings where loads occasionally have to be raised at different points in the building.



THE HOIST IS EASILY CARRIED BY TWO MEN

Reminder Clock

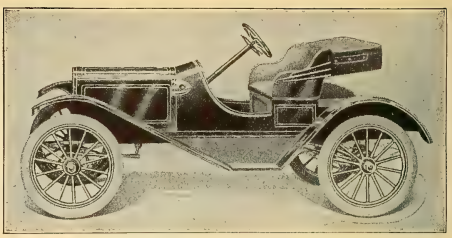
A clock that may be set to ring an electric bell at a given time as a reminder of an engagement to be kept is the subject of a patent issued to G. Schneider, C. W. Rutenbeck, and H. Hill, of Cleveland, Ohio.



REMINDER CLOCK

Four studs, set at the quarter hours and a part of the bell circuit, are touched by an oval projection on the under side of the minute hand as it moves around the dial. To complete the circuit, however, a stud located where the hour hand will be at the required time must be moved in its slot towards the center. When both hands come in contact with their respective studs the bell rings. Upon the front of the clock base are two card cases for holding cards upon which the names of persons and times of appointments may be written.

Smallest Electric Runabout

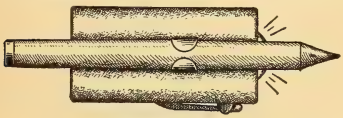


SMALLEST ELECTRIC RUNABOUT

What is believed to be the smallest electric car of the runabout type is called the Electra. It weighs only 550 pounds and is equipped with fourteen cells of battery contained under the front bonnet. Power is transmitted from the motor shafts by two standard motorcycle type V belts. Three speeds from 6 to 20 miles an hour are provided for.

Electric Pencil Holder

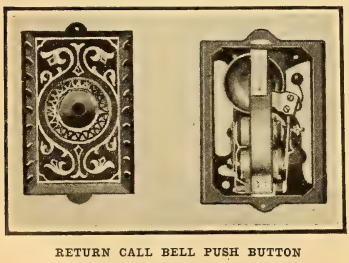
A little device is now on the market in the form of a very small battery and lamp with a pencil holder attachment. It permits writing in dark places, the light falling on the paper at the pencil point. It may also be used as an ordinary pocket flashlight.



PENCIL HOLDER

Return Call Button Hides Call Bell

When the hotel clerk, in accordance with a request for an early morning call, presses a button in the office corresponding to the room number and thus rings a bell in the room, he cannot tell whether the call is effective until the return push button is pressed. This button either sounds a buzzer or bell, or throws an annunciator in the hotel office. The room bell and return push button are often widely separated, the latter being not always easy to find. The arrangement illustrated removes the difficulty by being constructed to conceal the call bell behind the return call button and rids a well appointed room of an exposed bell.



RETURN CALL BELL PUSH BUTTON

Long Cord Turn Down Lamp

An improvement in electric lamps which will be appreciated in sick rooms is the long distance turn down lamp consisting of the usual Hylo lamp, containing a large and small filament either of which may be turned on or off or the lamp turned out by pulling a string. A three strand silk covered extension wire, as long as may be desired, is connected to a pull chain switch, that may be placed at the head of a bed within easy reach. The lamp only need be renewed when burned out.

LONG CORD TURN DOWN LAMP

Electrical Men of the Times

SAMUEL GROENENDYKE McMEEN

"He is an optimist, habitual and confirmed, with a big, active brain, a happy smile and a beaming eye." Thus is Samuel G. McMeen characterized by one who has known him for years.

He was born November 28th, 1864, at Eugene, Indiana, and received a college training at Purdue University in his home state. Telephone work received his attention from the beginning of his career, his first service being with the Central Union Telephone Company in 1885. In 1893 he became assistant to the chief engineer and in 1896 assumed the office of chief engineer for the company. A still bigger place sought him when in 1902 he took charge of the telephone central office equipment department of the Western Electric Company.

Two years later the firm of McMeen and Miller of Chicago was formed. Its primary purpose was to give special attention to telephone engineering, but as much railway, light and power work is now being taken care of as work of the other class.

Among the railway projects now directed from Chicago is the Mt. Hood Railway and Power Company, Portland, Oregon, of which Mr. McMeen is president. He is also president of the Columbus Railway & Light Co., which operates the electric railway, lighting and power properties in Columbus, Ohio.

One of the large engineering problems carried through by Mr. McMeen was the designing and building of the automatic system of the Bay Cities Home Telephone Company in San Francisco, Oakland and Berkeley, Cal. He followed this up by directing the operation of this $9,000,000 property until upon a paying basis and in this direction Mr. McMeen combines with his engineering skill unusual executive ability. One of the characteristics tending to his success is his care in laying down a policy and then holding unerringly to it.

Mr. McMeen has been a frequent contributor to the technical press. His most recent addition to engineering literature is a comprehensive and standard work "Telephony," in the preparation of which he collaborated with Mr. Kempster B. Miller.

Among his friends Mr. McMeen has the reputation of adding to his natural abilities as an entertainer, skill in charming the ear with his manipulations of the flute and piano. As to a hobby, he is credited with being a good chemist and physicist, having spent his leisure time in this field from mere love of the subjects. He is a member of the American Institute of Electrical Engineers, Western Society of Engineers, National Electric Light Association, Oregon Society of Engineers and the American Railway Association. He is also a member of the City and the Union League Clubs of Chicago, the Olympic Club, San Francisco, and the Arlington and Commercial Clubs, Portland, Oregon.

Electrical Interests of Women

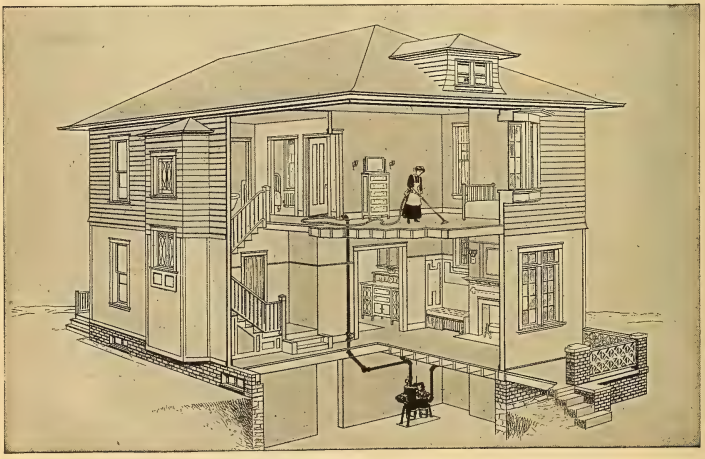
EDITED BY GRACE T. HADLEY

Modern House with Vacuum Cleaner

Here is a home equipped with a vacuum cleaner in the basement. A pipe leads to the various floors. Inlet couplings are located at convenient places. One end of the hose is attached to the inlet coupling, the other end to the cleaning tool. A strong suction draws all dust through the cleaning tool, hose and pipe into a sealed dust bucket attached to the machine in the basement. The maid turns a nearby electric switch, which starts the machine in the basement, and this makes a strong suction. She moves the vacuum nozzle rapidly over the walls, ceilings, woodwork, pictures and all furnishing which need dusting. The dust is not scattered, it is removed and the suction of air conveys it to the basement.

A ten inch vacuum renovator drawn over carpet or rug removes dirt, sand, lint, insects and moth eggs. A felted sweeper is used for hardwood or tile floors. It is so constructed as to pass under furniture, radiators or get into corners. Then the maid turns the electric switch and stops the machine.

It is maintained by some that in designing the house of the future the same consideration will be given to installing pipes for vacuum cleaning as for the present steam and water service.



HOUSE PIPED FOR VACUUM CLEANING SYSTEM

Service Kitchen Cabinet

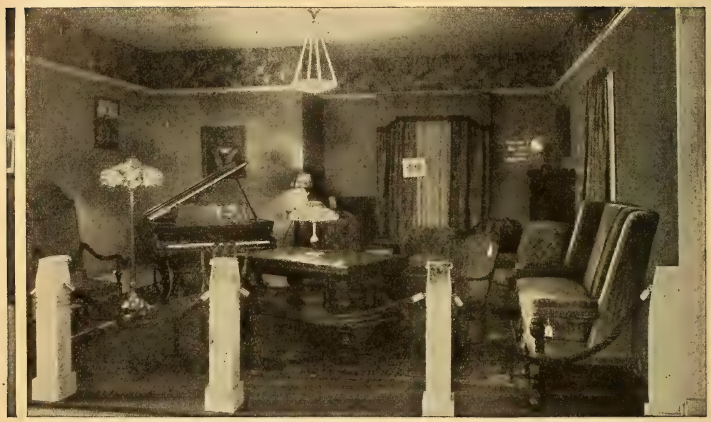
The Service kitchen cabinet is an ideal house combination with several services in one space. The principal features are a kitchen cabinet with flour bin and sifter, package cupboard, a metal covered table top, extension bread board, two electric fireless cookers, storage drawers, ice box with refrigerated food chambers above and below.

The kitchen cabinet is the center of all kitchen activities. It takes the place of the old fashioned kitchen cupboard, flour barrel, pantry and kitchen table, refrigerator and fireless cooker, while occupying very little more space than an ordinary kitchen cabinet. It is a handsome piece of furniture, made of hardwood with white enamel finish.

Formerly it was considered necessary to place the stove as far as possible away from the ice box. In this new and handsome addition to the modern kitchen the cooker and the cold chamber are side by side, with the cooker well insulated, of course, with mineral wool and packed with non-conducting and fireproof material. Electricity makes possible this remarkable combination of kitchen conveniences.

SERVICE ELECTRIC CABINET WHERE COOKER AND REFRIGERATOR ARE BUT A FEW INCHES APART

There is a place for everything. It brings kitchen utensils and provisions together where they may be easily reached as needed. It saves steps and labor. When the pie or bread is ready for the oven, a simple turn of the switch provides the necessary electric heat which is stored and confined in the aluminum lined chamber, thus affording a saving in fuel bills and of time usually deemed necessary for cooking.



PARLOR IN THE HOUSE ELECTRIC

Observations at a Household Show

Two grandmothers were there, one alert and eager eyed, another feeble and filled with the pathos of a passing generation.

"Oh," exclaimed the first, after inspecting an automatic kitchen cabinet, with two fireless cookers, electric stoves, refrigerator and cold food chamber all in one combination, "how I would like to live my life over again and have all these wonderful things to work with!"

"I am glad my time is almost up," remarked the other old lady, "because I don't think I could keep up with all these new fangled things. They are so different from anything I ever had in all my life."

"Keeping up with things electric" is the watchword for the Twentieth Century housekeeper. It is impossible to stand still in a world that moves. A Household Show is an object lesson on a large scale and it is the duty of every housewife to avail herself of such an opportunity to keep up with things electric.

"How handsome is the House Electric!" was the universal verdict. "It certainly represents the most perfect combination of art, comfort and convenience." It was an admirable demonstration of distribution of lights, small units or large units, how to avoid glare and shadow and how to locate fixtures. In lighting the Twentieth Century home, the problem is not one of quantity, but one of quality; not how to secure enough light, but how to secure the right kind of light in the right place. The primary law of illumination is that glare must be avoided at any cost. Glare strains and blinds the eye. Light should be steady, soft and evenly distributed.

In all large rooms there should be several sources of light. In the parlor of the House Electric there was a central fixture of the indirect system and a floor lamp in gold with colored mosaic shade. It was a work of art in beauty of form

BEDROOM IN THE HOUSE ELECTRIC

and color. In any similar room, a table lamp to give a soft but brilliant light, with a genuine art lamp for another source of illumination, makes a very happy combination.

The library had a central fixture and wall brackets with candle effect. A branching floor standard, table lamp and portable lamp afforded the concentrated light necessary for reading or for library work.

For the dining room of the artistic home, brilliant general illumination is not desirable. A combination of the direct and indirect system, with wall brackets in this model home, answered every decorative and useful purpose. The furniture was carved in French Gothic style.

In the nursery there was a central fixture for general illumination and wall brackets with cunning gnomes as the decorative design, while the bedroom was illuminated by a center fixture of the indirect system, which shed a soft glow from above. A pier glass with four handsome lamps, mirrors with side brackets and a dressing table equipped with lotus bulbs, made an ideal and effective place for the mysteries of milady's toilette.

The Brown bungalow was an artistic setting for electric and combination fixtures and portables in a silver brown finish. Harmony was the keynote throughout. Fixtures, woodwork, drapery and furniture harmonized most beautifully with art glass tones in electric chandelier, wall brackets, table lamp and electric portable lamp.

"I would like to have about six hundred dollars," was the wistful and wishful remark of a housewife, "and just buy all the electric things that I see here. I have a laundry iron, an electric iron, and that has been such a comfort and convenience to me I want everything electric and I shall not be satisfied until I get what I want."

The principle of electric fireless cookers includes metal chambers with metal plugs, the chambers packed in non-conducting and fireproof material, and plates, electrically heated, made of iron for storing up heat, which, thus confined, forms a very economical method of cooking. Meals can be started and left in the cooker while the housewife goes shopping or to church.

THE GARDEN OF EDEN

The Garden of Eden was one of the clever exhibits. It was the historical garden modernized and brought up-to-date with a home laundry machine, designed to do the most laborious work in the household and do it well without fuss or complaint. It represents the open door of Paradise for every descendant of Eve. It may be attached to any electric light fixture by simply screwing in the plug, the same as a lamp is put in. It will wash everything from doll clothes to the finest fabrics. The filmiest lace curtains are washed as successfully as the heaviest spreads or blankets and everything comes out spotlessly clean and sweet.

Color Scheme Cookery

An art teacher who became the proud possessor of an electric chafing dish desired to cook some rhubarb in the spring of the year. She had seen her mother prepare the plant, so she washed and trimmed and cut it into little pieces, just as she had seen her mother do. Then her cooking knowledge failed, and as her mother was many miles away, she resorted to cook books, but not one contained a single line of advice on how to cook rhubarb. Then she proceeded in desperation to put over the plant about a quart of water and some sugar.

The chafing dish then resembled a miniature pond with tiny green fish swimming in it, so the art teacher, who was very, very skilful in art work, cast about for something to fill up the pond. Her eye fell upon several oranges, and she decided that the yellow of the oranges would look well and harmonize with the delicate green of the rhubarb, so two oranges were peeled and dropped in. The pond filled up and the color scheme was so satisfactory that she decided to add part of a grapefruit and bits of lemon. She was now delighted with the hues and colors evolved by the simmering stuff, but somewhat dubious as to how it would taste. She decided to try it on father that night at dinner. With beating heart she waited while he tasted it.

"Why, Jessamine, this is delicious! What is it?"

"Oh!" cried she; "I am so glad you like it. It is a new sauce just concocted."

"I don't remember that your mother ever cooked rhubarb this way," reflected her father.

"Probably not," murmured the artistic cook. "I don't think mother ever made a fizzle of cooking plain rhubarb, and she always cooked it the plain, old fashioned way, but this is——" She searched her mind wildly for the proper term, and then added, breathlessly: "This is color scheme cookery."

The president of a big company bought an electric washing machine recently. When he sent in his check for payment, this note was attached:

"Here you are at last. Do I get a guarantee for one year? Mrs. A—— did the washing this morning and I made up all the beds before any one was up in the house."

Illumination of Works of Art

A recent exhibition of paintings of the Grand Canyon of Arizona by Thomas Moran, the famous landscape painter, was an attraction at a Chicago art gallery. The main entrance room in this gallery is lighted by the semi-indirect system. Three handsome Alba bowls each containing three 60-watt tungsten lamps are suspended from the ceiling. The glare of the tungstens is thereby changed to a mild, yellow light perfectly diffused, thus rendering the illumination easy and agreeable to the eyes. All of the wonderful Moran paintings were illuminated by individual reflectors.

Some of the new art on recent exhibition is reminiscent of the Venetian attitude towards color. Arthur G. Dove's paintings are characterized by the artist himself as color experiments rather than a representation of obvious facts.

Cezanne, an artist of sunny France, turned from the rendering of the effects of light to the expression of color as it is affected by light. His hues burn with the absorbed heat and vitalizing glow of sunlight. Matisse, following out this idea, assumed the mental attitude of a primitive man who, impressed with weight or bulk of an object, might try to express those abstract qualities by line and color, and thus some of the present day French art replaces representation of form by rendering its abstraction.

Fortunately, the æsthetic capabilities of the incandescent lamp are by no means exhausted, and the color experiments of the Proportionists or Post-Impressionists, burning with the vitalizing glow of sunlight, may still be enjoyed and marveled at under gray northern skies, if viewed under modern artificial illumination.

The selection of a proper illuminant to obtain true color values is a very important matter in interior lighting, particularly in an art gallery where paintings and water colors, mezzotints in colors and colored etchings are exhibited. The best illumination is that which produces color values nearly akin to diffused sunlight.

The efficiency in light distribution for an interior depends upon three important factors: The distribution of light emitted by the illuminating unit; the size of the unit and the locations of centers of light distribution.

INDIRECT ILLUMINATION IN THE ART INSTITUTE, CHICAGO

A gallery in the Art Institute, Chicago, 38 by 50 feet, with ceiling nineteen feet high, has a very interesting installation of indirect illumination. Mr. Burnham, the architect, was very desirous of an illumination that would not give an annoying reflection from the glass at any angle, the pictures being in frames and glazed. In this gallery there is an elimination of individual picture reflectors and every picture is evenly illuminated. The great feature of this system is the elimination of annoying reflection from

pictures either done in oil or under glass on any wall space where the system is used.

From practical installations it has been found that about 3.5 to four foot candles constitute proper intensity for art gallery illumination. This intensity is obtained by carefully developed reflectors placed at the proper distance from ceiling inside of bowls, combined with proper ceiling and wall tints. A light cream is recommended for the ceiling and light tan for the side walls. In looking at a portrait it is desirable to secure a clear picture on the retina of the eye. In order to do this it is necessary to keep the pupil of the eye widely opened and all bright light or luminous sources of light rays must be kept from directly entering the eye. One of the chief advantages of the incandescent lamp is that it admits of pleasing, shaded, decorative effects. The less exposed the lamps are in the direct line of vision, the less amount of actual illumination is required.

What the Motorist Shall Wear

In the luxurious cars which roll through the city streets, one sees delightful visions, for to the woman who is the possessor of an electric vehicle, all fashions are possible. The motor woman who rolls leisurely out to the country club for tea, spins along the boulevard to an afternoon reception or drives through the parks on summer afternoons, must be clad in charming togs much less sportsmanlike than the severe outfit designed for a drive over country roads in the touring car, where clothing is exposed to all kinds of weather and hard usage. There are now so many women who use the electric vehicle for town use, to the exclusion of other modes of locomotion, that particular attention is paid by designers to the raiment appropriate to this service.

The modish coat of white serge or other white wool, to be worn over summer frocks, should be a part of every woman's motoring outfit. Loose, ample, soft, light of weight and chic of line and detail, it adds much to the attractiveness of the motorist. Ratine is perhaps the most conspicuous of all white materials

ATTRACTIVE MOTOR HAT OF COARSE STRAW, ORNAMENTED WITH TWO RIBBON ROSES AND WITH VEIL ATTACHED

for this purpose, and certainly makes the smartest coat possible. The collar and cuffs of such a coat should be detachable, for since it is of necessity easily soiled, and ratine, being all wool, perfectly washable, coming from the tub as good as new, it is not a difficult matter to keep the coat in a perfect condition.

Tussor, pongee or gold cloth are excellent materials for the light weight wraps. There is an elegance about a coat of the heaviest quality of imported tussor, lined with Persian foulard, and decorated with very large buttons of white glass.

The latest bonnets are fashioned in exact reproduction of the fascinating, close fitting bonnets worn by the Holland milk women. Delightfully coquettish, shielding the neck and keeping the hair flat, they are ideal for motoring.

Veils are no longer simply straight and long in form. The newest ones form a

JAUNTY AFTERNOON WRAP, LINED AND TRIMMED WITH STRIPED MATERIAL

Capuchin hood, or a Burnouse loop. They are made of one long strip of mousseline de soie, simply hemstitched at the ends. This season decrees that veils shall match the motor hats.

A folded sunshade that closes and fits inside a hollow handle of turned wood is a necessary accessory for the motor woman. There is a twist of silk to match the parasol attached by a silk rosette. The handle is grained like bamboo and there is a steel stem and a hinge by which it may be adjusted to give shade in any direction.—Mrs. A. Sherman Hitchcock.

The Tragedy of Wash Day

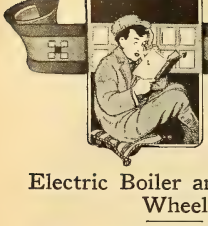
In an eastern magazine, Hashimura Togo, a Japanese boy-of-all-work, confesses his struggles with American housekeeping, especially on wash day. He describes the approach of the Hon. Maggie Kelley, prepared to drown all clothing in suds.

"Togo," she say so, "my duties require it. Cleaning things is a job full of tragedy and other grouch. It would be unnatural to laugh while washing. Clothes is pleasanter to wear, but unpleasant to scrub. It is similar with everything. Dishes is joyful to eat from, but nobody admire them when the hour of the dishpan arrive. Nobody love Monday because it is sacred to splash and suds, yet if Monday was abolished by Congress, there would be no beautiful society on Saturday night."

Can't some variety of soap be invented with more poetry in it? Togo wishes to know.

"It could," she say, "but it would probably be useless to take the dirt out."

Possibly if the Hon. Maggie and Togo used an electric washing machine, the job of washing would be less tragic and there would be no necessity for soap with more poetry in it, as all modern electric washing machines are guaranteed to take the dirt out. At the same time, Togo would probably have just as many adventures and funnier, as he seems predestined to make amusement.



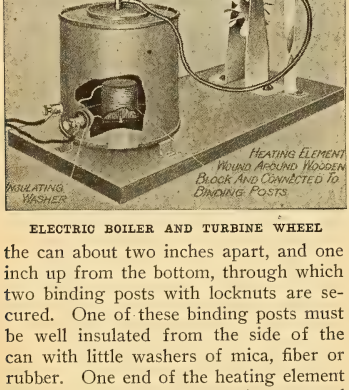
Junior Section

Electric Boiler and Turbine Wheel

This boiler is intended for use in connection with a step-down transformer, supplying current at a pressure of 20 volts.

Procure a quart can, such as a corn syrup can. Make a ¼ inch hole in the center of the bottom of the can and screw down thereon a little wooden cylinder about one inch in diameter and 1½ inches high.

Make two ¼ inch holes in the side of



ELECTRIC BOILER AND TURBINE WHEEL

the can about two inches apart, and one inch up from the bottom, through which two binding posts with locknuts are secured. One of these binding posts must be well insulated from the side of the can with little washers of mica, fiber or rubber. One end of the heating element is soldered to the side of the can, and this latter binding post is also soldered to the can so as to be steam tight. The washers on the other binding post will prevent leakage of steam. As long as the solder is submerged in water, it will not melt, neither will the wooden cylinder burn, around which the heating element is wound. The heating element consists of one foot of No. 28 Calido wire, or about two feet of German silver wire of the same size. A radiator valve is soldered into the can and on this is placed a piece of rubber tubing to carry the steam to the turbine wheel.

It helps materially to wrap the boiler up tightly in two thicknesses of asbestos paper to prevent loss of heat. Fill two-thirds full of water and connect to the 25 volt tap of the transformer. Using warm water to start with, steam will be up in about two minutes. The heat may be regulated by changing to a higher or a lower tap on the transformer. The heating element must always be submerged. Some current undoubtedly short circuits through the water, but enough goes through the heater element to answer the purpose. The resistance of pure water is very high.

To make the turbine, cut a disk of thin, soft tin four inches in diameter. Punch a small hole in the center, and solder on a pin to serve as a shaft. Make sixteen cuts around the periphery of the disk about 1½ inches deep, dividing the disk into approximately equal segments. With a pair of narrow nosed pliers twist each of these segments around at an angle with the surface of the disk. Then with a pair of small, round nosed pliers bend each of the segments into crescent section to form the buckets or blades. A small drop of solder judiciously applied, or a little filing will correct the balance. Mount the wheel upon tin strips as shown.—Wesley G. Paulson.

A Miniature Pleasure Park

The miniature pleasure park illustrated here is a remarkable example of mechanical genius, having attracted the attention of thousands of people. This is the work of George W. Haslam, a mechanic of Pittsburgh, Pa., who spent his spare time for about three years in perfecting the many details.

The tiny park is operated by electricity, constructed upon a platform two feet high, fifteen feet long and nine feet wide. The merry-go-round is fitted with animals, such as deer, tigers, elephants, bears, camels, giraffes and horses, on the backs of which ride such comic characters as "Happy Hooligan," "Gloomy Gus," "Foxy Grandpa," "Little Nemo," "Flip," "Dr. Pill," etc., etc. The aerial swing has twelve boats, in which dolls seem to be enjoying themselves immensely. The dancing pavilion has eighteen miniature people, the outside circle of six couples revolving as if in the act of waltzing. The swings, of which there is a group of four, are fashioned after those seen at large pleasure parks, where the occupant does the work by pulling at a rope. The Ferris wheel has six coaches filled with little people, while the roller coaster is equally well patronized by the pleasure seekers who move about in a wonderful way. At the entrance of the vaudeville show are two ballet dancers and two clowns who give a free continuous performance of amusing stunts.

The house has furnishings and electric lights, while on the lawn is a see-saw and lawn swing for the amusement of the children. In the rear there is a zoo and a wind mill in operation near by. The park entrance, which faces on a paved and electric-lighted street crowded with pedestrians, autos and delivery wagons, is an elaborate one, being ornamented with tiny electric lights, statuary and fine art paintings. Extending around the entire park, which is encircled with a neat picket fence, is a double track on which electric lighted trolley cars run rapidly, propelled by storage batteries.

A TINY PARK OPERATED BY ELECTRICITY AND CONTAINED ON A PLATFORM FIFTEEN FEET LONG AND NINE FEET WIDE

The Luminous Goblet.

A pleasing experiment with static electricity may be arranged in the following manner: A large goblet of thin glass is mounted by means of three small screws which clamp the periphery of its base upon a small whirling table, Fig. 1. A single narrow strip of tinfoil one-sixteenth of an inch wide is cemented over the surface of the glass, beginning under the foot of the goblet at the metallic spindle of the whirling table, with which there is electrical contact. The strip proceeds to the edge of the foot of the goblet, which it follows for about an inch, thence in a curved direction across the upper surface of the foot to the stem,

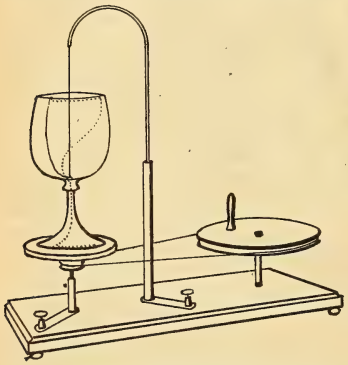


FIG. 1. ELECTRICAL AND ROTATING ATTACHMENTS OF THE LUMINOUS GOBLET

which it ascends vertically, then upward over the surface of the bowl in a sinuous path to the upper rim, after following which along the outside very near the top for about two inches it descends upon the inside and terminates at the bottom. That portion of the foil strip upon the outside of the goblet is divided transversely every eighth of an inch with the point of a sharp penknife. Current from a static machine or induction coil is led into the strip through binding ports connected respectively to the spindle of the whirling table and to the lower end of a

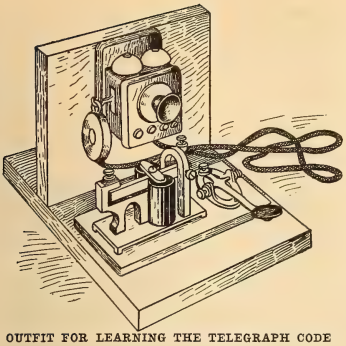
FIG. 2. THE LUMINOUS GOBLET

vertical conducting standard of stiff wire rising from the base of the apparatus at some distance from the goblet. The curved upper end of the standard terminates in a straight, stiff, slender wire, the lower end of which reaches down inside the goblet nearly into contact with the end of the tinfoil strip. A piece of glass tubing covers the lower portion of the standard for insulation. Some idea of the beauty of the experiment when performed in a dark room is obtained from Fig. 2.

Learning the Telegraph Code

Two persons who wish to assist each other in learning the telegraph code will find the apparatus and its arrangement as illustrated in the accompanying cut a great help.

Run an ordinary telephone line between the two houses, mounting the telephone upon the vertical board. In front of the telephone place a sounder and key, connected to battery. When the

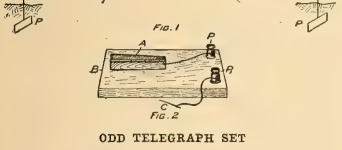


OUTFIT FOR LEARNING THE TELEGRAPH CODE

sounder is operated with the receivers off the hooks, the other party will be able to distinguish the dots and dashes. Besides this either party may talk with and criticize the other without taking the fingers from the key. Many amateurs to whom I have suggested this plan have reported most favorably upon it. W. F. MURPHY.

An Odd Telegraph Set

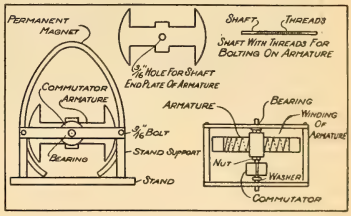
An interesting and instructive telegraph set with an unusual key may be made according to the following instructions and will work over short distances. Plates (PP), Fig. 1, one of zinc and the other of carbon, are buried in the ground at the ends of the line as shown. Two small single pole knife switches are placed in the circuit at each station near the telephone transmitters (R). Shunted around each switch is (S) the key board or "sending key." This consists of a file (A), Fig. 2, mounted upon a base of wood (B) and connected to the finding post (P). The other part of the key consists of a heavy metal pointer fitted into a wooden handle and connected by a flexible wire to the other binding post (P) of the key base. In sending, the sending party opens his switch (K) while the receiving party closes his and listens for dots and dashes in his transmitter, or watch case receiver (R). Dots are made by striking the file with the pointer and dashes are made by drawing the pointer over the file surface. HARRY E. WAID.



ODD TELEGRAPH SET

To Make a Small Magneto

The magnetic field is supplied by a permanent magnet of the horseshoe type. The armature consists of eight or ten pieces of No. 27 sheet steel, cut as shown. The armature sheets are kept in place on the shaft by a nut which is screwed up firmly on either side before the commutator is put on. The bearings are made of heavy tin, with a $\frac{3}{16}$ inch hole in each end, and one in the center to take the shaft.



PARTS OF A SMALL MAGNETO

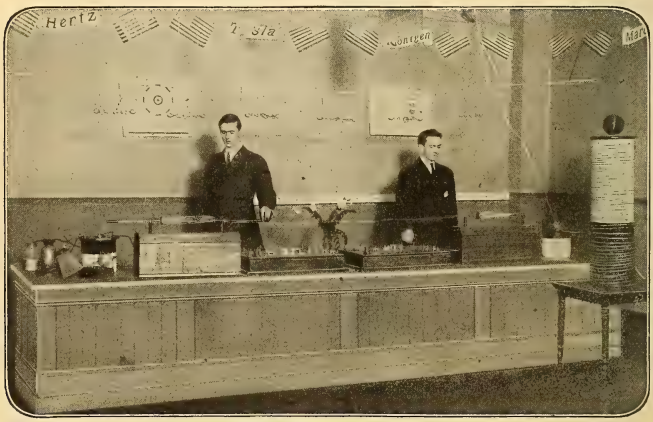
Drill four $\frac{3}{16}$ inch holes in the magnet to take the bearings.

The stand consists of four pieces of heavy tin screwed to the magnet on each side with the bearing and is nailed to the wooden base. A threaded shaft carries the armature. The commutator is a wooden cylinder which is forced onto the shaft. It is covered with tinfoil which

must be securely glued on and afterwards cut in two pieces to make the two segments.

Wind the armature with five or six layers of No. 22 magnet wire as shown and glue the two ends one to each segment of the commutator, taking care to get a good connection. This machine will run at high speed on dry cells.

F. D. Hickman.



EXPERIMENTING WITH A LARGE INDUCTION COIL

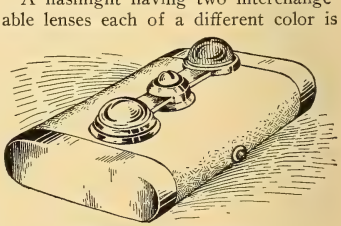
Experimenting with Large Induction Coils

Ralph W. Smith and Fred D. Schenck, two students in the School of Engineering of Milwaukee, furnished considerable instructive entertainment at a recent public exhibition. The lighting of Geissler tubes and incandescent lamps, without wire connections, held in the field of the Tesla coil, the production of sparks several inches long from the same coil to the extended hand and the operating of the X-rays were some of the interesting experiments performed by the students.

The accompanying illustration shows two sixteen inch spark coils connected in series with each other and with two "Franklin plate" condensers and a Tesla coil. The secondary winding of each of these spark coils contains 100,000 turns of No. 36 enamel magnet wire, or a total length in the two coils of over 23 miles.

Flashlight for Signaling

A flashlight having two interchangeable lenses each of a different color is the latest novelty in this line upon the market. The lenses are secured at the ends of a metal strap pivoted in the middle so that either lens may be swung over the battery lamps. A flashlight of this type will be found serviceable for the use of Boy Scouts in their field work.



DOUBLE COLOR FLASHLIGHT

Wireless Outfits for Small Boats

BY RICHARD H. FOSTER.

Owners of small craft and motor boats are fast realizing the value of wireless for communication purposes. Motor boats, house boats and cruisers, especially those in Southern waters, find wireless valuable for receiving storm warnings, as the South is a bad place for storms. Fishing fleets as well as cruising parties find it valuable. Its latest use has been for reporting races from the judges' boat to the club house.

All this use of wireless apparatus has aided in the development of portable outfits. Many boats only require the apparatus for a short time, and, moreover, loose apparatus requires too much room. The portable outfit has, therefore, been received very favorably by motor boat people as its compactness is a valuable feature, and the apparatus is, to a large extent, protected.

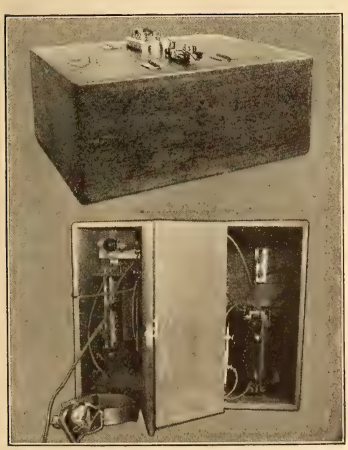


FIG. 1.—WIRELESS OUTFIT FOR SMALL BOATS

The outfit herein described is a simple portable type, suited for small boats, and can be used for communication over three or four miles. Simplicity is an important feature, as the ordinary boat owner is very unfamiliar with wireless and does not care to learn a lot of rules for operating the set. The outfit described has been received very favorably by the motor boat people and is supplied by one firm on its boats. I will now describe the actual construction of an outfit of this type.

All of the apparatus used in this outfit, except the case, is to be purchased from electrical dealers. This method is cheaper in most cases.

In Fig. 1 the top half shows the outside and general appearance of the outfit, with telegraph key and aerial switch mounted on the cover; the lower half shows the interior of the case. In taking the latter photograph the case was inverted so that the receiving apparatus is on the left and sending on the right, instead of vice versa. When the case is placed with the telegraph key in front the receiving apparatus is on the right, and the sending on the left.

The case can be made by any carpenter for seven or eight dollars. It should be constructed of ½ inch oak, the base being of one inch thickness. The case should be stained dark, like mission oak or in imitation mahogany. A dark stain wears better, however. All the dimensions of the case and the scheme for locating the different parts of the apparatus are shown in Fig. 2 and the accompanying keys.

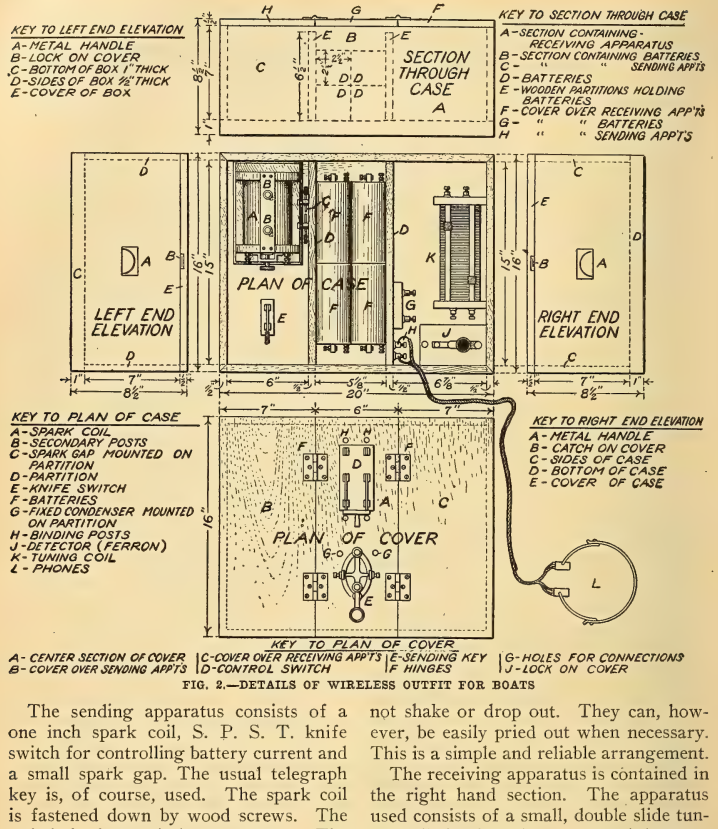


FIG. 2.—DETAILS OF WIRELESS OUTFIT FOR BOATS

The sending apparatus consists of a one inch spark coil, S. P. S. T. knife switch for controlling battery current and a small spark gap. The usual telegraph key is, of course, used. The spark coil is fastened down by wood screws. The switch is fastened the same way. The spark gap posts are removed from the wood base and mounted directly on the partition separating the sending apparatus from the batteries.

The batteries are contained in the next section. Eight square dry batteries are used.

The batteries are in two layers, and are held in place by a forced fit. If the section is exactly 5⅛ inches in width the batteries can be forced in place and will not shake or drop out. They can, however, be easily pried out when necessary. This is a simple and reliable arrangement.

The receiving apparatus is contained in the right hand section. The apparatus used consists of a small, double slide tuning coil, fixed condenser, crystal detector, and a pair of 1,000 ohm head phones. The fixed condenser is placed on end and glued to the partition. Two large binding posts for the phones are also mounted on this partition.

The tuning coil is firmly glued on the bottom and one side to the side of the case, as shown. The detector is either glued or fastened with screws. Extra heavy furniture glue should be used, as this will hold the heavy weight easily.

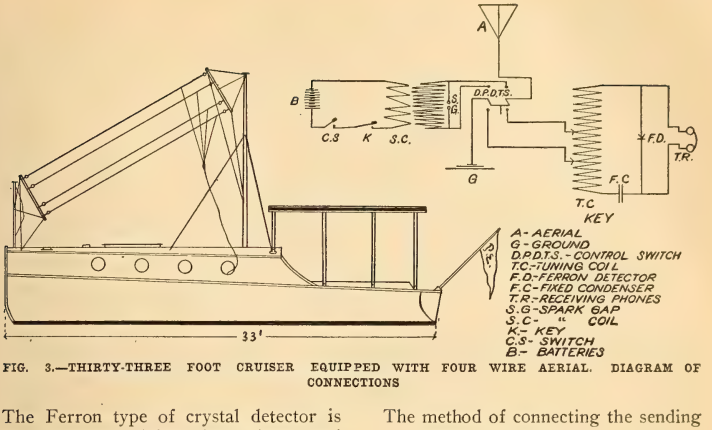


FIG. 3.—THIRTY-THREE FOOT CRUISER EQUIPPED WITH FOUR WIRE AERIAL. DIAGRAM OF CONNECTIONS

The Ferron type of crystal detector is very reliable and has always been used by the writer with good results. This completes the receiving section.

All wiring should be done with extra heavy flexible wire. Automobile primary wire is a good type. It is about ¼ inch in diameter and exceedingly flexible. It has good insulating qualities and is proof against rain and damp. The receiving compartment will be found plenty big enough to hold the head phones.

The aerial is the next question. As the outfit was practically designed for marine use, I will only describe the type used on small boats. Fig. 3 shows a 33 foot cruiser equipped with a simple four wire aerial. This is suspended from the signal mast which all boats of this size carry. Spreaders about six feet long of light wood should be used. Porcelain cleat insulators give good results. Ground is made by soldering a wire to the engine frame or bed plate. Boats having a steel hull can use this for the ground connection.

On very small boats a portable aerial mast in sections is handy to use. These can be made of bamboo or ordinary wood. The aerial itself is always constructed practically the same, whether large or small.

The method of connecting the sending and receiving apparatus is illustrated.

This outfit has many novel features worth enumerating. It is portable in every sense of the word, sending apparatus, receiving apparatus, and batteries all being contained in one case; the total size of case being only 20 by 16 by 8½ inches; all apparatus is protected from dirt, dampness, etc.; the outfit can be easily carried around as it weighs about 50 pounds; the aerial and ground leads can be connected and disconnected in a few seconds, and finally the outfit will stand all kinds of rough handling, none of the apparatus being breakable.

All things considered, this outfit is about as compact and useful as could be desired for short distance work.

Capacity of Condensers

The following is a simple formula which may be used to determine the capacity of a condenser for use when building same or tuning up the various circuits:

$$C = \frac{2.248\ Ba}{D \times 10 \times 10}$$

In this B is the inductivity of the dielectric between the tinfoil or metal plates of the condenser; a is the area in

square inches of all the dielectric sheets actually between and separating the condenser plates; and D the average thickness of the dielectric sheets in inches.

Below is a list of the most common substances that are used in the manufacture of condensers. The inductivities of these substances are given so that the formula can be worked out:

Material.	Inductivity B.
Dry Air, Ordinary Pressure	1.0000
Manila Paper	1.50
Paraffin, solid	1.68 to 2.32
Resin	1.77 to 2.55
Ebonite	2.05 to 3.15
India Rubber	2.22 to 2.49
Gutta Percha	2.46 to 4.20
Shellac	2.47 to 3.60
Glass	3 to 3.25
Mica	4 to 8
Porcelain	4.38
Light Flint Glass	6.47
Dense Flint Glass	10

Where the inductivities vary, it is best to take an average result.

B. Francis Dashiell.

Regulation of Amateur Radio-Operation

By EUGENE PETERSON

The recent Titanic disaster, and the confusion in wireless operations attendant thereto, brings before the public, more forcibly than before, the need of a means for regulating amateur wireless operations. While it is true that the Titanic's call for help was not interfered with, later efforts to get detailed information made by many Navy and commercial stations were rendered unavailing because of the chaotic state of the ether. The interference in the case of the Titanic is nothing unusual. It has occurred in the case of every shipwreck and will occur again if means are not adopted to regulate radio-operations. Perhaps the reason that even more interference was not experienced in this particular instance is due to the fact that the disaster occurred at about 2 a. m., a time when few amateurs are operating.

From time to time, during the past few years, a bill has been up before the Senate for the regulating of wireless telegraph operations. The suggested remedies have been many and varied—some practical, others not. Before discussing the proposed regulations, however, it might be well to consider the offenders themselves.

Broadly speaking, amateurs may be divided into two classes—a higher and a lower one. The former may be said to embody for the most part serious minded young men who take up wireless more as a study, good operators usually, and possessing up-to-date and selective apparatus. The other consists of dilettantes who consider wireless as a toy and treat it as such—filling the air with their meaningless dots and dashes for the doubtful pleasure of hearing the crash of their spark; operators who, whether they possess high or low powered apparatus, are aptly classified as "nuisances of the ether."

Interference with Navy and commercial stations by amateurs is mostly unintentional but sometimes malicious. The malicious interference is probably the worst and is either the outcome of a desire to get revenge on the station because of its interference in the amateur's operations, or else of a mischievous spirit. This malicious interference is generally caused by the less intelligent class and is one of most importance. If a bill be passed to regulate wave lengths or power, knowingly or otherwise, it will probably be violated. The imposition of a tax upon wireless stations will merely eliminate the owners of small stations, leaving the bigger plants to interfere, regard-

less of the kind of operator to whom they belong. Obviously the above methods do not suffice in this case.

Only the amateur himself can eliminate this evil under present conditions. He alone knows the station persistently interfering. If he will report that station to the government or commercial stations who are being interfered with, he is working for the best interests of the amateurs as a whole. Some may say that this method is cowardly and altogether childish, but what of the man who interferes? Have you ever considered the harm he does? A false message sent or interference when brought before the public gives a bad name to amateurs as a whole. The unintentional interference is usually caused by the higher class and may be eliminated by restriction of wave lengths. In cities where stations are close together, a great deal of interference is caused by forced oscillations. This cannot be eliminated by restriction of wave lengths, the only remedy being to have no stations of high power near the Navy or commercial stations. A great deal of interference is also experienced because, when a station sends out 99, the amateur cannot understand him.

The most satisfactory way of solving the problem of interference is to require the owner of a station to have a license certifying that he is a capable operator. It may also be used to limit the power, if desired—to perhaps one kilowatt. These examinations for amateur licenses could be held by the government in school buildings, etc., the expense incurred to be paid by a nominal tax on each amateur and could be held semi-annually. A speed of fifteen words Morse or Continental per minute, and a fair knowledge of adjusting should be required.

I have shown that the amateur's salvation rests mainly with the amateur himself. Any effort to regulate radio-communication without the amateur's support will be worse than useless. The license system is used in England, and no serious interference is encountered. Why not in America?

Questions and Answers in Wireless

By A. B. COLE

DETECTORS (CONTINUED)

The audion consists of an incandescent electric lamp having a platinum plate near the filament within the globe. The connections for the audion are shown in Fig. 20, where (P) is the plate, (F) is the filament, (A) is the battery required to heat the filament to incandescence, and (B) is the local battery connected with the telephone receiver and the audion. Battery (A) generally has a voltage of from six to twelve, and (B) has from five to eighteen dry cells so arranged that any number may be connected as desired.

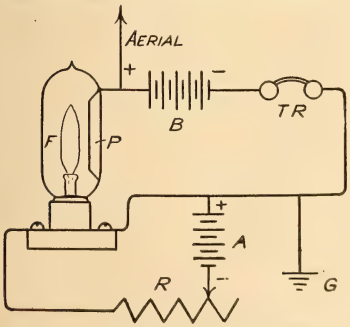


FIG. 20.—CONNECTIONS OF THE AUDION

The action of the audion is said to be that of a rectifier and a relay, due to the fact that the platinum plate is comparatively cool, and the filament is hot, which causes a difference in the resistance of the path from the plate to the filament, and vice versa.

In operating the audion, the filament is brought to full brilliancy and the voltage of battery (B) is regulated to a point just below that at which a violet discharge takes place within the bulb.

The main difficulty with the audion of the present day is that the filament has a short life, and the instrument is not equally sensitive at all stages of its life.

61.—*Upon what laws is the action of an electrolytic detector based?*

The present form of electrolytic detector consists of a cup containing a dilute solution (about ten per cent) of sulphuric or nitric acid, having two electrodes immersed in this solution. One of these electrodes is of carbon, platinum, or other inactive substance, and the other consists of a very fine platinum wire (diameter generally about .0001 inch) which can be raised from or lowered into the solution very slowly. This fine platinum wire is known as Wollaston wire, which is coated with silver by the manufacturers. The silver dissolves off when it is immersed in the acid.

A local battery of two dry cells is connected with a potentiometer which is in series with a telephone receiver or

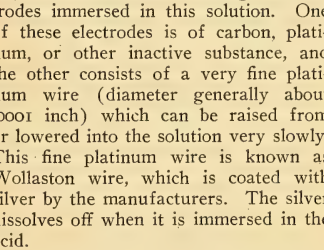


FIG. 21.—ELECTROLYTIC DETECTOR

pair of receivers and the detector, so that the voltage across the detector-telephone circuit may be varied at will. The negative pole of the battery is connected to the Wollaston wire.

The battery current flowing through the telephone receivers and the detector decomposes the water of the acid into hydrogen and oxygen, the former appearing at the point of the Wollaston wire in the solution of acid. Hydrogen gas is a good electrical insulator, and so long as it remains at this point the battery current cannot flow through the detector. As soon as electrical oscillations flow into the detector, however, their high voltage breaks down the resistance of the hydrogen and allows the battery current to flow through the detector. As soon as the oscillations cease, the hydrogen produced at the point of the Wollaston wire prevent the battery current from passing.

The construction of an electrolytic detector is illustrated in Fig. 21.

Some believe it preferable to connect the positive pole of the battery to the Wollaston wire. In this case oxygen gas is liberated at the point of the wire and acts in the same way as the hydrogen.

In another form of electrolytic detector the Wollaston wire is replaced by a platinum wire sealed in a glass tube and filed off flush with the glass so that only a small surface of platinum is exposed.

The lead peroxide detector is sometimes considered as an electrolytic. This detector consists of a small piece of chemically pure lead peroxide held between one electrode of platinum and one of lead. A fairly heavy pressure is exerted on the peroxide by the electrodes. A local battery in connection with a potentiometer should be used with this detector as with the electrolytic.

The lead peroxide is sometimes taken from the positive plates of storage batteries, but this material is not satisfactory, as the local battery decomposes the water of the acid remaining in the peroxide and causes a hissing sound in the telephone receivers, which prevents the operator hearing signals from a distance. This detector is quite sensitive when the peroxide is pure, but is not, in our opinion, as sensitive as the silicon or the carborundum detector.

Directory of Wireless Clubs

This directory of amateur wireless clubs and associations will be published each month. When a new club is formed the names of the officers, also the street address of the secretary, should be forwarded to us at once. Any changes that should be made in the directory, when designated by an official of a club, will be made in the next issue after receipt of such advice.

Aerogram Club.—J. Stedman, President; A. Hayward Carr, Chairman Board of Directors; Albert S. Hayward, Treasurer; Donald P. Thurston, Secretary; Walter B. Clarke, 17 May St., Newport, R. I., Corresponding Secretary.

Aerograph Club of Richmond, Ind.—H. J. Trueblood, President; Richard Gatzek, Vice President; James Pardieck, 320 South 8th St., Richmond, Ind., Secretary.

Aero Wireless Club.—A. Garland, President; W. Ladley, Vice President; D. Beard, Napa, Calif., Secretary and treasurer.

Allegheny County (Pa.) Wireless Association.—Arthur O. Davis, President; Theodore D. Richards, Vice President; James Seaman, Leetsdale, Pa., Secretary and Treasurer.

Alpha Wireless Association.—L. L. Martin, President; F. A. Schaeffer, Vice President; G. F. Girton, Box 57, Valparaiso, Ind., Secretary and Treasurer.

Amateur Wireless Association of Schenectady, N. Y.—D. F. Crawford, President; L. Beebe, Vice President; C. Wright, Treasurer; L. S. Uphoff, 122 Ave. "B," Schenectady, N. Y., Secretary.

Amateur Wireless Club of Geneva (N. Y.).—H. B. Graves, Jr., President; C. Hartman, Vice President; L. Reid, Treasurer; Benj. Merry, 148 William St., Geneva, N. Y., Secretary.

Berkshire Wireless Club.—Warren A. Ford, President; William Yarkee, Vice President; Charles Hodecker, Treasurer; Jas. H. Ferguson, 18 Dean St., Adams, Mass., Secretary.

Canadian Central Wireless Club.—Alexander Polson, President; Stuart Scorer, Vice President; Benj. Lazarus, P. O. Box 1115, Winnipeg, Manitoba, Can., Secretary and Treasurer.

Cardinal Wireless Club.—K. Walthers, President; F. Dannenfelser, Vice President; Miss A. Peterson, South Division High School, Milwaukee, Wis., Secretary.

Chicago Wireless Association.—John Walters, Jr., President; E. J. Stien, Vice President; C. Stone, Treasurer; D. Northland, Secretary; R. P. Bradley, 4418 South Wabash Ave., Chicago, Ill., Corresponding Secretary.

Custer Wireless Club.—Franklin Webber, President; Fred Cross, Vice President; Oakley Ashton, Treasurer; Walter Maynes, 438 Custer Ave., Los Angeles, Cal., Secretary.

Fargo Wireless Association.—Kenneth Hance, President; John Bathrick, Vice President; Earl C. Reineke, 518 9th St., Fargo, N. D., Secretary.

Forest Park School Wireless Club—W. S. Robinson, Jr., President; William Crawford, R. F. D. No. 1, Springfield, Mass., Secretary.

Frontier Wireless Club.—Chas. B. Coxhead, President; John D. Camp, Vice President; Franklin J. Kidd, Jr., Treasurer; Herbert M. Graves, 458 Potomac Ave., Buffalo, N. Y., Secretary.

Gramercy Wireless Club.—James Platt, President; John Gebhard, Vice President; John Diehl, Treasurer; John Jordan, 219 East 23d St., New York, N. Y., Secretary.

Independent Wireless Transmission Co.—Starr W. Stanyan, 76 Boston Ave., West Medford, Mass., Secretary.

Northwestern Wireless Association of Chicago—Rolf Rolfson, President; H. Kunde, Treasurer; Edw. G. Egloff, 2729 Noble Ave., Chicago, Ill., Recording Secretary.

Hannibal (Mo.) Amateur Wireless Club.—Charles A. Cruickshank, President; J. C. Rowland, Vice President; William Youse, Treasurer; G. G. Owens, 1306 Hill St., Hannibal, Mo., Secretary.

Haverhill (Mass.) Wireless Association—Riedel G. Sprague, President; Charles Farrington, Vice President; Leon R. Westbrook, Haverhill, Mass., Secretary and Treasurer.

Independence Wireless Association.—Royce Miller, President; Ralph Elliott, Secretary; Joseph Mahan, 214 South Sixth St., Independence, Kan., Vice President.

Jonesville Wireless Association.—Frederic Wetmore, President; Webb Virmylia, Vice President; Richard Hawkins, Treasurer; Merritt Green, Lock Box 82, Jonesville, Mich., Secretary.

Lake View Wireless Club.—E. M. Fickett, President; R. Ludwig, Treasurer; R. F. Becker, 1439 Winona Ave., Chicago, Ill., Secretary.

Long Beach Radio Research Club.—Bernard Williams, 555 E. Seaside Bvd., Long Beach, Calif., Secretary.

Manchester, (N. H.) Radio Club.—Homer B. Lincoln, President; Clarence Campbell, Vice President; Elmer Cutts, Treasurer; Earle Freeman, 759 Pine St., Manchester, N. H., Secretary.

New Haven Wireless Association.—Roy E. Wilmot, President; Arthur P. Seeley, Vice President; Russell O'Connor, 27 Vernon St., New Haven, Conn., Secretary and Treasurer.

Oakland Wireless Club.—H. Montag, President; W. L. Walker, Treasurer; W. R. Sibbert, 916 Chester St., Oakland, Calif., Secretary.

Oregon State Wireless Association.—Charles Austin, President; Joyce Kelly, Recording Secretary; Edward Murray, Sargeant-at-Arms; Clarence Bischoff, Lents, Ore., Treasurer and Corresponding Secretary.

Peterboro Wireless Club.—G. B. Powell, President; C. V. Miller, Vice President; E. W. Oke, 263 Engleburn Ave., Peterboro, Ontario, Can., Secretary and Treasurer.

Plaza Wireless Club.—Paul Elliott, President; Myron Hanover, 156 E. 86th St., New York, N. Y., Secretary and Treasurer.

Rockland County (N. Y.) Wireless Association.—W. F. Crosby, President; Tracey Sherman, Vice President; Marquis Bryant, Secretary; Erskine Van Houten, 24 De Pew Ave., Nyack, N. Y., Corresponding Secretary.

Roslindale (Mass.) Wireless Association.—O. Gilus, President; E. T. McKay, Treasurer; Fred C. Fruth, 962 South St., Roslindale, Mass., Secretary.

Sacramento Wireless Signal Club.—E. Rackliff, President; J. Murray, Vice President; G. Banvard, Treasurer; W. E. Totten, 1524 "M" St., Sacramento, Calif., Secretary.

Santa Cruz Wireless Association.—Orville Johnson, President; Harold E. Sentor, 184 Walnut Ave., Santa Cruz, Calif., Secretary and Treasurer.

Southeastern Indiana Wireless Association—R. F. Vanter, President; D. C. Cox, Vice President and Treasurer; H. Hitz, Fairmont, Madison, Ind., Corresponding Secretary.

Southern Wireless Association.—B. Oppenheim, President; P. Gernsbacher, 1435 Henry Clay Ave., New Orleans, La., Secretary and Treasurer.

Springfield (Mass.) Wireless Association.—A. C. Gravel, President; C. K. Seely, Vice President and Treasurer; D. W. Martenson, Secretary; Club Rooms, 223 King St., Springfield, Mass.

Spring Hill Amateur Wireless Association.—R. D. Thiery, President; H. P. Hood, 2nd, 2 Benton Road, Somerville, Mass., Secretary and Treasurer.

St. Paul Wireless Club.—Thos. Taylor, President; A. R. Moore, Vice President; E. C. Estes, Treasurer; R. H. Milton, 217 Dayton Ave., St. Paul, Minn., Secretary.

Tri-State Wireless Association.—C. B. DeLaHunt, President; O. F. Lyons, Vice President; T. J. M. Daly, Treasurer; C. J. Cowan, Memphis, Tenn., Secretary.

Waterbury Wireless Association.—Weston Jenks, President; Alfred Upham, Treasurer; H. M. Rogers, Jr., 26 Linden St., Waterbury, Conn., Secretary.

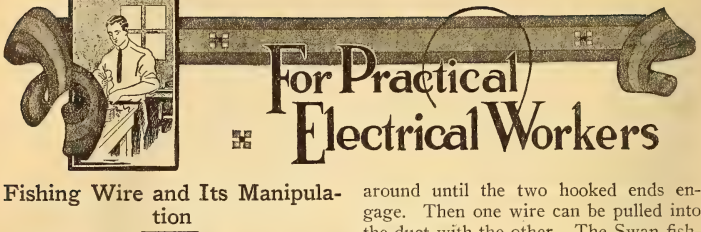
Wireless Association of British Columbia.—Cliffton C. Watson, President; J. Arnott, Vice President; E. Kelly, Treasurer; H. J. Bothel, 300 Fourteenth Ave. E., Vancouver, B. C., Corresponding Secretary.

Wireless Association of Canada.—W. Fowler, President; F. G. Lunn, Vice President; W. C. Schuur, Secretary and Treasurer.

Wireless Association of Montana. Roy Tyssel, President; Elliot Gillie, Vice President; Harold Satter, 309 South Ohio St., Butte, Mont., Secretary.

Wireless Club of Baltimore.—Harry Richards, President; William Pules, Vice President; Curtis Garret, Treasurer; Winters Jones, 728 North Monroe St. Baltimore, Md., Secretary.

Wireless Club of the Shortridge High School.—Robert C. Schimmel, 2220 N. Penn St., Indianapolis, Ind., President; George R. Popp, Vice President; Bayard Brill, Treasurer; Oliver Hamilton, Secretary.



Fishing Wire and Its Manipulation

Fishing wire is tempered steel wire of rectangular cross section, Fig. 1. It is a grade of wire that is used sometimes for corset steels and can be obtained at corset factories and at electrical supply

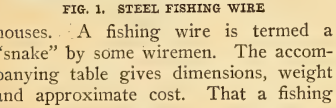


FIG. 1. STEEL FISHING WIRE

houses. A fishing wire is termed a "snake" by some wiremen. The accompanying table gives dimensions, weight and approximate cost. That a fishing

W Width, Inch.	T Thickness, Inch.	Weight Per 100 Feet.	Approximate Price, Per pound.	Per foot.
⅛	.015	11 oz.	$90.00	$0.62
⅛	.030	1 lb. 4 oz.	60.00	0.75
3/16	.030	1 lb. 14 oz.	60.00	1.13
¼	.030	2 lb. 8 oz.	60.00	1.50
5/16	.035	3 lb. 8 oz.	55.00	1.93
⅜	.035	3 lb. 12 oz.	55.00	2.06

wire may slide readily past small obstructions, hooks should be bent in its ends as shown in Fig. 2. Before bending, the

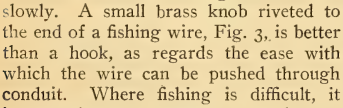


FIG. 2. HOOKING THE ENDS OF FISHING WIRE

ends should be annealed by heating them to a red heat and allowing them to cool slowly. A small brass knob riveted to the end of a fishing wire, Fig. 3, is better than a hook, as regards the ease with which the wire can be pushed through conduit. Where fishing is difficult, it is sometimes necessary to push two "snakes," with hook ends, into the wire way, one from each of the outlets, as shown in Fig. 2. The wires must be worked back and forth and twisted around until the two hooked ends engage. Then one wire can be pulled into the duct with the other. The Swan fishing wire for conduit, shown in Fig. 4,

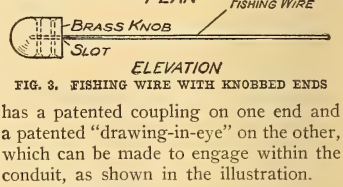


FIG. 3. FISHING WIRE WITH KNOBBED ENDS

has a patented coupling on one end and a patented "drawing-in-eye" on the other, which can be made to engage within the conduit, as shown in the illustration.

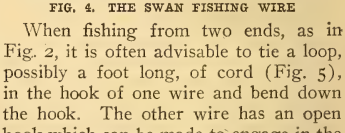


FIG. 4. THE SWAN FISHING WIRE

When fishing from two ends, as in Fig. 2, it is often advisable to tie a loop, possibly a foot long, of cord (Fig. 5), in the hook of one wire and bend down the hook. The other wire has an open hook which can be made to engage in the

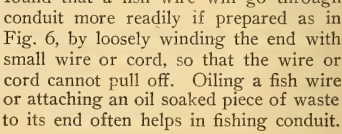


FIG. 5. USE OF THE CORD LOOP

cord loop quite readily. It has been found that a fish wire will go through conduit more readily if prepared as in Fig. 6, by loosely winding the end with small wire or cord, so that the wire or cord cannot pull off. Oiling a fish wire or attaching an oil soaked piece of waste to its end often helps in fishing conduit.

Chain is used for vertical fishing. A small chain can be made to drop down a vertical wire way with little difficulty.

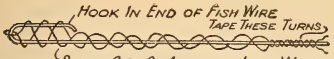


FIG. 6. TO MAKE THE WIRE DRAW EASILY

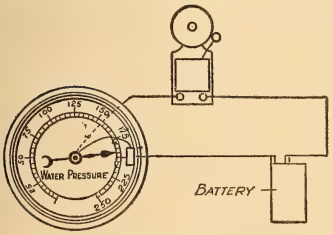
The noise made by the lower end of a chain will disclose its location almost exactly.

Galvanized steel wire can be used for fishing. Any size from No. 14 up to possibly No. 6, as occasion demands, may be utilized, and in nearly every case the flat steel ribbon wire will be found preferable.—Henry Clows.

Water Pressure Signal

An ingenious attachment to a pressure gauge gives notice of abnormal pressures on an automatic sprinkler system, in case the steam regulating device on the fire pump gets out of order.

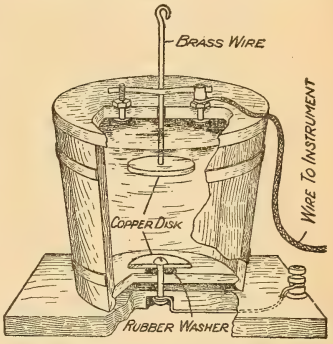
A piece of stiff brass wire in the shape of a hook is attached near the center of the indicator hand of the pressure gauge and a small metal cup containing mercury is attached to the face of the dial at the edge, just so the hand is not interfered with. The wire is so arranged that it moves over the dial with the hand. When an excessive pressure is registered the end dips into the mercury and in so doing completes an electric circuit which sounds a large gong, notifying the engineer of the trouble.



WATER PRESSURE SIGNAL

Adjustable Water Rheostat.

An ordinary wooden pail will serve very readily in the construction of a variable water rheostat. The inside of the pail should be thoroughly covered with hot paraffin and a wooden cover provided. In the bottom of the pail place a circular piece of copper four inches in diameter and hold this down upon a sheet of rubber by a small brass bolt. Solder the head of the bolt to the copper and lead a wire out to a binding post as shown. For the upper plate solder a two inch copper plate to a No. 8 copper wire of such length that when the upper disk is close to the lower disk, four or five inches of the wire will project through the pail's cover. To hold the brass wire at any position desired, solder a flat strip of spring brass to the binding post on the cover in such a position that it will press against the copper rod when swung against it and over a second projecting bolt.

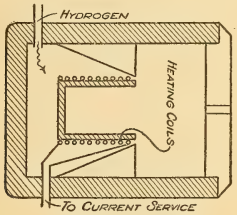


ADJUSTABLE WATER RHEOSTAT

This rheostat is adjustable within wide limits. Pure water has considerable resistance, but by adding a little sulphuric acid, or else common salt, this resistance is decreased. By careful adding of acid or salt and at the same time adjusting the disk a very accurate control of the current may be obtained.

A New Electric Furnace

Tungsten is a metal which is melted with the greatest difficulty. Owing to its high melting point it has displaced many metals in various industrial applications. It is now the most desirable lamp filament material known. It is very



ELECTRIC FURNACE

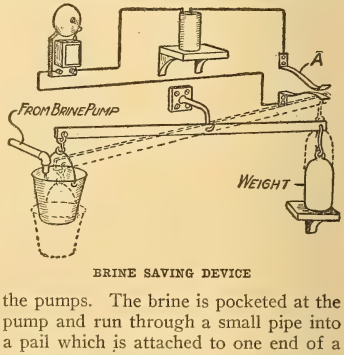
rapidly displacing platinum from use on sparking points of induction coil vibrators and promises to be used extensively in spark plugs.

Besides many other applications, tungsten is found to be a very desirable material for electric furnaces of the resistance type. The resistance furnace consists merely of a metal wire surrounded by refractory substances. It is more compact and therefore is more popular than the arc furnace in small sizes and where a temperature as high as the arc furnace is not desired.

Electric current when passed through a metal produces heat which is radiated or conducted away by the surrounding material. Of course, the highest possible temperature attainable depends upon the melting point of the resistance wire used. Platinum, which was formerly very desirable as a resistance material for this type of furnace, melts at 3200 degrees Fahrenheit, while tungsten melts at a temperature above 5000 degrees Fahrenheit. The latter metal, however, has one drawback, because it unites with the oxygen in the air at a temperature much below the melting point of platinum. This is overcome by not permitting air to come in contact with the metal. The furnace is sometimes made by using a tube of the metal surrounded inside and outside by porcelain, but a later development is shown in the sketch. All parts are of porcelain or some highly refractory substance excepting the heating coil, which is of tungsten wire. Hydrogen gas, which has no effect on tungsten, at high temperatures is admitted through the tube in the bottom of the furnace and burns at the top of the inner vessel. A large current is sent through the coil and a very high temperature is obtained. With this furnace platinum is easily melted.

Brine Saving Device

A very simple but effective device is used in the engine room of a Chicago department store for saving the brine on a refrigerating system, which leaks out through the piston rod packing of



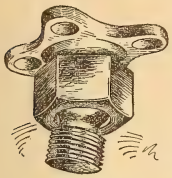
BRINE SAVING DEVICE

the pumps. The brine is pocketed at the pump and run through a small pipe into a pail which is attached to one end of a lever bar, supported in the center and with a weight at the other end not quite so heavy as a pail of brine. When full, the pail trips the lever, the apparatus takes the position shown by the dotted lines in the diagram, and in so doing presses the brass contact points together at (A), thus closing an electric circuit and ringing a bell. An attendant then empties the brine back into the system and the pail is replaced.

W. R. REYNOLDS.

A Fixture Straightener.

Few outlets in ceilings are straight. Time is wasted in trying to make the box straight and often it is loosened and weakened by attempting to do so.

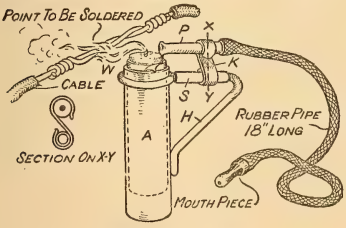


FIXTURE STRAIGHTENER

The Federal fixture straightener overcomes these troubles. It is a ball and socket joint which can be tightened or loosened by turning the nut which contains the socket. Once the fixture is plumb the nut is tightened.

Emergency Torch for Electricians

The following device, made at the expense of a few cents, will enable wiremen and others to solder all ordinary sized wires usually met with in practice and besides can be used for a variety of other purposes. An ordinary wax candle (A) is wrapped tightly with two or three thicknesses of what is known as build-



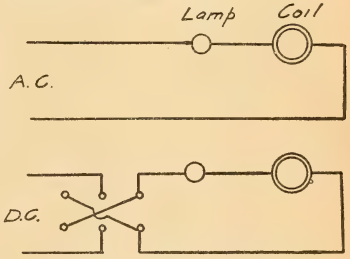
EMERGENCY TORCH

ers' paper and fits snugly into an outer metallic tube. This latter is easily made from a sheet of tinware by lapping and soldering the edges. A piece of No. 6 copper wire (H) is soldered at top and bottom to the outer tube. A smooth brass tube (S) fits over the wire tightly and is fastened to same. On this the clip (K), though tightly set, will turn to right or left of the flame, or slide laterally as desired. The nozzle (P) is made from a two inch piece of common clay pipe and has on its outer end a rubber pipe as shown. When in action the molten wax is held in place by the paper cartridge surrounding it, the presence of which and its quality having much to do with the efficiency of the torch. As these burn out they are fed upward through the hollow tube by pressure from below.

—T. E. Heys.

Apparatus for Demagnetizing a Watch

Very often those who work around electrical machinery find that their watches become "magnetized." The watch or any other article can be easily demagnetized by the very simple method shown here. Take a coil of wire such as



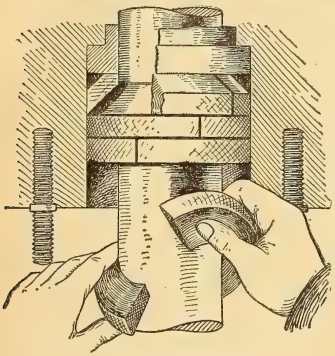
CIRCUITS FOR WATCH DEMAGNETIZING

an old transformer coil and connect it in series with any current limiting apparatus such as an incandescent lamp. Now connect the terminals to a plug and insert the latter into any lamp socket on an alternating current lighting circuit. The magnetic field inside the coil reverses many times per second. Place the watch or any other article to be demagnetized in the coil and pull it away in the direction of the axis of the coil. Repeat the operation.

If alternating current is not at hand a reversing switch, made of a double pole double throw switch, can be used. When the reversing switch is operated rapidly the same result can be obtained, if a battery of a few volts is used.

A Galvanic Packing

Even the field of steam packings has now been invaded by electricity and in a novel way. The new packing material consists of very thin rings of paper plated on both sides with nickel or copper and



GALVANIC PACKING

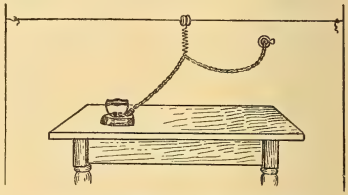
alternated with layers of asbestos. Being deposited electrolytically, the plated metal is quite pure and exceedingly durable. Moreover, the friction on rods moving in boxes packed in this way is said to be only a quarter of what it is with the ordinary packings. In practice, the rings as built up from the plated paper and the asbestos are split at one side so that they can easily be inserted as shown in the cut.

Fans for Sealing Room

In a certain department of a government building where packages are wrapped, then sealed with sealing wax, the air has been laden with the smell of the burning wax. The effect upon the men who worked the entire day was such that an employe in the sealing room could be identified immediately by his pallid complexion. Electric fans were installed and the air is now constantly being changed much to the comfort and health of the workers.

Wiring System for Electric Irons

Perhaps the greatest inconvenience about an electric iron is the fact that the flexible cord is continually in the way, trailing along behind, mussing up the work, and then not getting out of the way when the iron is moved back on its return trip. Some irons are equipped



CORD SUSPENSION FOR ELECTRIC IRONS

with a light coil spring, which helps some, but whose assistance can be made more effective by using the wiring system illustrated, and which requires nothing but a couple of hooks, a coil spring, a piece of wire and a porcelain insulator, or, failing that, an empty spool will do as well.

The insulator or spool is run upon the wire which is then strung across the room a little to one side of the worker's place and just high enough so that it will not catch her head. The coil spring is fastened to the insulator, which then acts as a sleeve, and the cord is hung from the spring, as shown in the diagram. The insulator slides back and forth, greatly extending the range of operation of the iron.

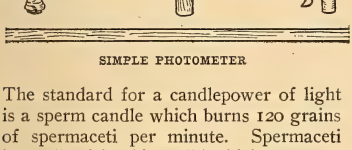
An Electric Water Heater

A simple water heater which is very useful during the summer can be readily made by means of a luminous radiator lamp inserted in an enveloping tin vessel. The electric lamps used in luminous electric radiators give off considerable heat. If this lamp be held rigidly in a tin vessel with the socket end upwards, a wire and plug serves to make a connection easy with any lamp socket. A small faucet

can be soldered in the bottom to add to its convenience. Carbon lamps should be used. For that reason the radiator lamp is chosen. The larger the wattage of the lamp the greater will be the amount of water heated in a given time.

A Simple Photometer

A photometer is an instrument for comparing the intensity of two sources of light. In using the photometer, one source of light must have a known candlepower, so that the intensity of the other source may be compared with it.



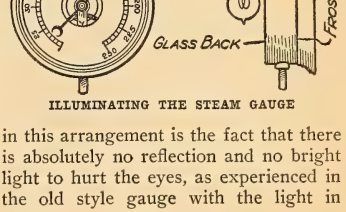
SIMPLE PHOTOMETER

The standard for a candlepower of light is a sperm candle which burns 120 grains of spermaceti per minute. Spermaceti is a yellowish-white solid which separates from oil obtained from the sperm whale and can be made into candles in the same way that tallow candles are made. With sperm candle, a piece of wood with sloping sides and a dark room, a given light source may be tested as described. When the face (A) of the wood is illuminated by the lamp and (B) by the candle, by looking down upon the two faces in the direction of the arrow, (A) will appear brighter than (B) if the block is midway between the two lights. Now move the block towards the feeble source until the two faces have equal light. Assume the block to be 40 inches from the lamp and ten inches from the candle. As the intensity of light upon an object decreases according to the square of the distance from the source, the light of the lamp is to the light given by the candle as the square of 40 is to the square of ten, or as 1,600 is to 100, or the lamp is sixteen times as bright as the standard candle.

For the purpose of performing the experiment merely to illustrate the principle of the photometer, an ordinary tallow candle or other source of light may be used. But it is necessary to have the relation between this source and a standard candle to find results in standard candlepower.

Illuminating the Steam Gauge

Steam gauges illuminated at the back are used in many boiler rooms. An incandescent electric lamp back of the gauge shines through a glass back, illuminating the figures printed on the frosted glass face. The great advantage

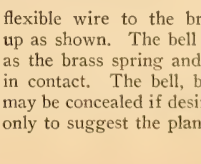


ILLUMINATING THE STEAM GAUGE

in this arrangement is the fact that there is absolutely no reflection and no bright light to hurt the eyes, as experienced in the old style gauge with the light in front.

Homemade Cash Drawer Alarm

An ordinary drawer may be readily equipped to ring a bell when opened. Above one edge secure a copper strip, regulating its length according to the position of the drawer desired to ring the bell. Upon the same side and on the drawer edge place a light piece of spring brass. Attach a flexible wire to the brass and connect up as shown. The bell will ring as long as the brass spring and copper strip are in contact. The bell, battery and wires may be concealed if desired, the cut being only to suggest the plan.



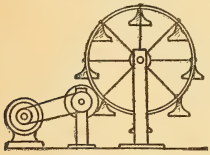
CASH DRAWER ALARM

Electricity the Silent Salesman

Some helpful hints on the use of electric current in getting up show window displays. The following schemes have all been used with remarkable success.

Ferris Wheel to Display Goods

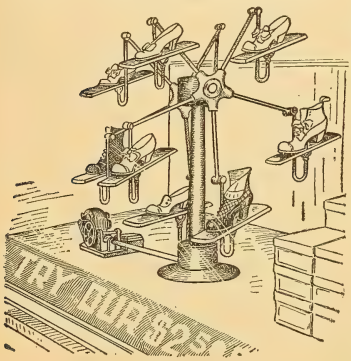
A revolving Ferris wheel with suspended shelving between the two circumferences is used to display numerous small articles such as perfumery, soaps, talcum powder, etc., in a Chicago drug store. The device is operated by a small motor belted to a second shaft which gives motion to a friction wheel bearing against a rim of the Ferris wheel. The friction wheel's circumference is covered with a band of rubber. The whole equipment sets upon a common base.



FERRIS WHEEL

A Double Motion Display Rack

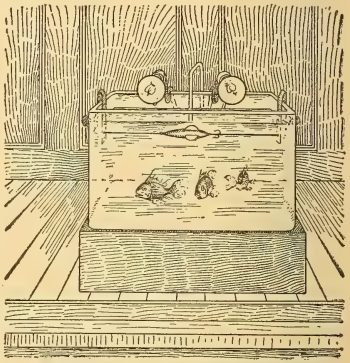
An English firm manufactures a decidedly novel apparatus for exhibiting shoes and other articles that can be displayed in a similar manner. The equipment is called a "roundabout" and has a double motion. While the goods are moved in a circle by the arms they are also carried about the central pillar. A special electrical equipment drives the device.



THE ROUNDABOUT FOR DISPLAYING SHOES

Attracting the Isaac Waltons

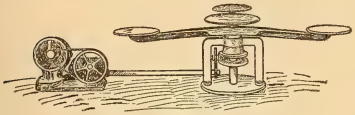
A dealer in sporting goods, particularly anglers' supplies, has an attraction in his show window that receives its share of attention. It consists of a glass tank containing several gold fish whose shining yellow bodies are brightened up by two incandescent lamps fastened on the edges of the tank. Stretched across between two clamps and under water is a wire supporting an artificial minnow. The body of the minnow has upon it four curved metal fins. Upon these plays a small stream of water from a tube connected to a faucet, causing the minnow to revolve rapidly as if being drawn through the water.



ADVERTISING ANGLERS' SUPPLIES

Auto-Rotor

This is an English device, motor operated, for displaying goods and figures

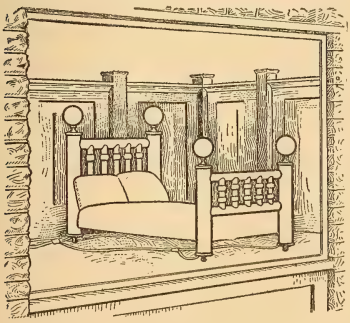


AUTO-ROTOR DISPLAY DEVICE

in shop windows. The plates are made with screw holes for fastening the articles in place. Short and long arms are provided where asked for, with gears for turning them in opposite directions. A one-twentieth horsepower motor is ample for operating the auto-rotor.

Light Fixtures on Bed

Something new in the furniture line and decidedly attractive as a show window display is a brass bedstead fitted with an incandescent lamp at the top of each post. The appearance of the bright

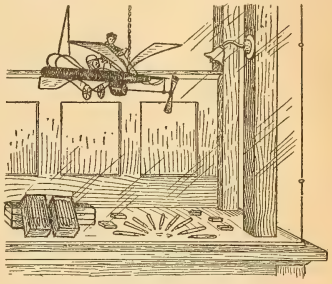


LIGHT FIXTURES ON BED

brass finish of the bed is heightened by enclosing the lamps in large cream-colored glass globes. The effect is such that with all four lights on, it would hardly be necessary to have other lighting fixtures in the room.

The Flying Fountain Pen

A big fountain pen fitted up with the accessories of a monoplane is used by a fountain pen maker as a show window attraction. Under the pen body is a small

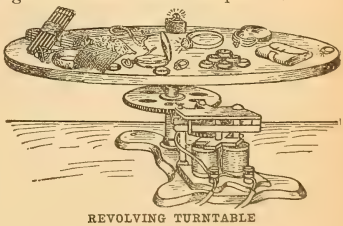


MONOPLANE WINDOW ATTRACTION

electric motor supplied by current from an adjacent lamp socket. The motor operates the propeller which keeps the equipment in motion about its point of suspension.

Revolving Turntable for Window

Jewelry, especially diamonds and brilliants, cannot be displayed to better advantage than when moving under the light of incandescent lamps. For this



REVOLVING TURNTABLE

reason the Green revolving turntable is especially adapted to the jeweler's show window, though quite as efficient in attracting attention with other displays. The table operates on either alternating or direct current or from batteries, which run an odd looking motor which adds to the attraction.

SCIENCE EXTRACTS FROM FOREIGN JOURNALS

MARCONI CONTRACT WITH BRITISH GOVERNMENT

A contract has been recently made between the British government and the Marconi wireless company for erecting a network of stations so as to connect the British possessions all over the world. As yet the project is in its first stages and the position of all the posts has not been determined, but there will be a central post at London and it will connect with stations in Egypt, Aden, Pretoria and Singapore. These will probably be erected in the first place in order to start the network and the others will come later. The terminus stations are to be fitted with apparatus for receiving 100 or 200 words a minute. According to the statements made by the Marconi company, it is to build the stations for the government and then operate them for the first six months, after which they will be turned over to the government administration. — *Lumière Electrique, Paris.*

INCREASING SIMPLON TUNNEL TRAFFIC

The number of passengers carried through the Simplon tunnel from Switzerland to Italy, over the electric railroad, is steadily increasing. Thus, in 1907 there were 365,344 passengers carried, and in 1911 the number increased to 410,030. The freight traffic has also increased considerably. There will be quite a stimulus given to electric railroading in Switzerland by the opening up of the new Lötschberg line which crosses the Alps and connects the northern part of the country with the Simplon tunnel at the south, thus giving a direct route from Germany to Italy. France will also benefit by this, as well as all the northern countries. It is expected that the new electric line will be opened for service in the spring of 1913. Trains will thus reach the Simplon tunnel, and passengers will be transferred to the Simplon electric trains in order to proceed on their journey to Milan, Rome and other places in Italy.—*l'Industria, Milan.*

ARTIFICIAL RUBBER

Seeing that the electrical industry as well as automobiles use great quantities of rubber, there is a good outlook for the production of artificial rubber, provided of course, that it has a good enough quality to take the place of natural rubber and is cheap as well. Several factories in Europe are now engaged in the question, and it is said that one of them is now turning out about 200 pounds of artificial rubber per day, starting with ordinary tar as a basis. To transform turpentine into rubber would seem impossible, but modern chemistry has solved as difficult problems as this, so that one day it will no doubt be an ordinary matter to produce rubber from such substances. This latter is claimed to be done by a Paris company lately organized.—*L' Electricien, Paris.*

ELECTRICITY FROM HOUSEHOLD WASTE

Electric current is now obtained in quite a number of plants in Europe by burning household waste, and this is a convenient means of getting rid of the refuse and at the same time current is had for nearly nothing. A good example is a large station erected at Frankfort, Germany, and it contains 24 furnaces for burning the waste, these being used to produce steam from six boilers. In this way there is given enough steam to run two steam turbines connected to dynamos so as to produce about 1,000 horse power. The plant is now burning about 240 tons of household waste per day, but it is soon to be enlarged so as to use a much larger quantity. It is also probable that a second plant of the kind will be built in the city before long.—*L' Electricien, Paris.*

A NEW ELECTRIC FURNACE

Dr. J. Harker is making some experiments in the National Physical Laboratory at London on an electric furnace for working at a very high heat and which does not use carbon. He obtained his idea from the Nernst lamp, and found that quite a number of substances could be made to act like the Nernst lamp; for instance, some kinds of clay pipe stem if much heated, to begin with, will then conduct the current well enough to glow afterwards by the action of the current alone. Carborundum crystal has a like effect, but does not need to be heated up beforehand. In this case the heat given by the current is so high that the silicon is volatilized off, and it burns in a cloud of silica.

A furnace was made on this idea, using a refractory tube of zirconia or other rare earths, and it was raised by means of current passing in a nickel wire winding to 500° or 600° C. Here the tube begins to conduct the current so as to allow the main or heating current to be passed through it. The first current serves as in the Nernst lamp, simply to heat up the tube to make it conducting, and is then cut off and a strong current is sent through the tube from one end to the other. Such an electric furnace is easy to build, and the heat is so intense that even platinum can be melted.—*Electrician, London.*

DEADENING THE HUM OF LINE WIRES

The question of deadening the humming sound which is heard on telegraph or telephone lines has been occupying the German telegraph department, as where the lines pass through towns they are often mounted upon houses and this is giving rise to much complaint from the noise which they make. The device which has been tried on some of the Dresden lines consists of two stout half-cylinders of cement which carry a groove on the flat side for holding the wire. The inner sides are covered with a layer of soft cement, then the wire is laid in the groove and the two halves are bound together by wrapping with wire. The cylinder thus prepared is mounted in a suitable way upon the house in order to hold the wire.—*Revue Electrique, Paris.*

TESTING WINE WITH A TELEPHONE

Messrs. Brunot and Daussay are experimenting with a somewhat curious method of analyzing wines by the use of an electric current, and presented their first results at a meeting of the French Acadamy of Sciences. They find that different samples of wines will conduct the current more or less, so that we have here an indication as to their makeup. A tube filled with the wine to be tested is placed in the circuit of a telephone so that the current must pass through it. If the wine is pure it conducts the current very well so that the sounds can be heard distinctly in the telephone. On the other hand, if it is adulterated, as often happens, with certain chemical salts, the current does not pass and there is no sound to be heard.—*Report of the Académie des Sciences, Paris.*

ELECTRIC CURRENT FROM SUNLIGHT

A Danish engineer, Chas. Winther, is engaged upon what he calls a "photo-pile" or battery for storing up the energy of light and then giving it out in the shape of electric current. He uses certain chemical solutions which are acted upon by light, and especially by the powerful ultra-violet rays, so that they are decomposed into other substances after a time. Then nothing happens until metal plates are put into the cell, and when a current is set up by the effect of the liquid on the plates somewhat as in a battery, so that electricity is produced as a result of the original action of the light. When the cell is run down, the first salts are found to be reproduced as they were at the start, so that the cell can be again acted upon by light.—*Genie Civil, Paris.*

NEW BOOKS

ENGINEERING AS A VOCATION. By Ernest McCullough. New York: David Williams Company. 1911. 201 pages. Price, $1.00.

A book published for the information of parents in order that they may act wisely in selecting a career for their sons. Chapters of special interest are: The Work of the Engineer, The Education of the Engineer, Home Study Courses, How to Hunt and Hold a Job, Does It Pay to Study Engineering?

KNOTS, SPLICES AND ROPE WORK. By A. Hyatt Verrill. New York: Norman W. Henley Publishing Company. 1912. 98 pages, with 148 illustrations. Price, 60 cents.

A book giving complete and simple directions for making all the useful and ornamental knots in common use. Campers, yachtsmen, travelers, boy scouts and others using rope will find it valuable.

HOUSE WIRING. By Thomas W. Poppe. New York: Norman W. Henley Publishing Company. 1912. 100 pages with 74 illustrations. Price, 50 cents.

The author writes in a manner to give readers a practical knowledge of the installation of electric lighting systems. The book should prove of special value to apprentices and helpers.

WIRING HOUSES FOR ELECTRIC LIGHT. By Norman H. Schneider. New York: Spon and Chamberlain. 1911. 86 pages with 42 illustrations. Price, 25 cents.

This book is written to illustrate only safe wiring and the rules of the Fire Underwriters are freely consulted. Fittings are illustrated and drawings made to make the text clear.

THE MODERN LOCOMOTIVE. By C. Edgar Allen. London: Cambridge University Press (New York: G. P. Putnam's Sons). 1911. 169 pages with 36 illustrations. Price, 40 cents.

A book sketching the general principles of the design and working of a modern locomotive from its predecessor 30 years ago to now. Combustion, feedwater heating and steam production are among the subjects that have received attention.

THE ROMANCE OF MODERN ELECTRICITY. By Charles R. Gibson. Philadelphia: J. B. Lippincott Company. 1910. 338 pages, with 37 illustrations. Price, $1.50.

The author has presented in an unusually attractive manner the story of electricity and its numberless applications. Beginning with the first chapter, "How We Came to Know About Electricity," the author holds the interest of the reader, who may know very little of the technical side, to the last page.

ELECTRICITY IN LOCOMOTION. By Adams Gowans Whyte. London: Cambridge University Press (New York: G. P. Putnam's Sons). 1911. 140 pages with 18 illustrations. Price, 40 cents.

One of a series of small volumes on scientific subjects. The story is briefly told of the part electricity has taken in locomotion from the earliest tramroads and railways to the present time.

MOVING PICTURES, HOW THEY ARE MADE AND WORKED. By Frederick A. Talbot. Philadelphia: J. B. Lippincott Company. 1912. 331 pages with 133 illustrations.

The author has endeavored to deal with the subject of moving pictures in a popular manner and in a way to interest moving picture show patrons. The work is in no way a practical manual, technicalities being avoided, but is written to introduce the reader to the world of animated photography from the viewpoint of the interested spectator.

BRAZING AND SOLDERING. By James F. Hobart. New York: Norman W. Henley Publishing Company. 1912. 51 pages with eighteen illustrations. Price, 25 cents.

This book contains simple directions for handling the soldering iron, applying the solder and preparing the work. Directions are given for making solders both hard and soft for all classes of work.

MOTION PICTURE HANDBOOK. By F. H. Richardson. New York: The Moving Picture World. 1910. 176 pages with 41 illustrations. Price, $1.50.

The information imparted in this book is for the manager of the moving picture theater and primarily for the man in the booth. The author has avoided technical terms and tells his story in a plain matter-of-fact style.

On Polyphase Subjects

All-British Cable to Canada

A movement is on foot in England to lay an all-British cable between that country and Canada, following the recent increase in the cables which now connect England with all the African colonies, Indian and Australia and thence to the west coast of Canada so that messages reach the Atlantic by overland lines. But here the British post stops, and the cable between Canada and the mother country is in other hands. Now there is much talk of making a direct connection so as to remedy this state of affairs. Private companies are not inclined to go into the scheme, as it is not likely to be a paying one, so that the government will be obliged to take it up. Negotiations with Canada are now going on, and the question is whether this latter country will feel able to meet its part of the expense.

Foot Amputated by Wireless Instructions

According to a recent press dispatch, a laborer on Swan Island, a lonely wireless station in the Gulf of Mexico, sustained a crushed foot; how the wireless operator on the island communicated with a ship 420 miles away, raised the surgeon and got him to explain the proper way to amputate, and how the operator's assistant performed the operation, is a story described by New Orleans physicians as "surgery by wireless."

On Swan Island is a wireless station, one of the links in the United Fruit chain to the tropics. When a laborer hurt his foot in a tram car accident the wireless operator concluded an operation was imperative. There were no medical books at hand, and no one at the station ever had hacked at a fellow being. Then the operator had an "inspiration." He called a fellow craftsman on a ship passing 420 miles below into the Caribbean sea. The situation was explained to the ship's surgeon, and detail by detail he explained just how the amputation should be handled.

After the arteries had been tied and the wound dressed the patient recovered his senses and insisted on pressing at the wireless key to express his thanks. At last accounts he was getting well.

Coating Metals With Lead

A new electric process for coating iron or steel with lead has been brought out by Mr. Cowper Coles, the eminent English specialist in electric depositing methods for metals, and it is claimed to be very economical to carry out. The amount of lead deposited on the iron can be varied as much as desired, from a fraction of an ounce up to several pounds per square foot. This is likely to open up a great increase in the application of lead coatings for various purposes in the industries, and these will be very useful; for instance, iron pipes can be lead lined inside and outside, so as to combine the strength of the iron and the protection from rust and other actions given by the lead. Such pipe can be coated only on the inside if need be, for corrosive liquids, and the method is good for the lining of pumps and for chemical vessels. It is even claimed that lead can be thus coated onto earthenware or wood, or again that it answers very well for protecting ornamental iron work.

Sunday School Teacher—"Now, children, I want a verse of Scripture from each one of you. Well, Percy."

Percy—"The Lord loveth a cheerful geezer."

* * *

A slightly inebriated gentleman was leaning against a corner of the building late at night, indulging in sundry chuckles while looking up at an immense electrical advertisement showing an automobile tire whirling round and round. A policeman stopped and asked him what amused him so. "Jush look up there m' fren'. Funnish sight I ever shaw. See the blamed milky way a chasin' its tail."

* * *

A German shoemaker left the gas turned on in his shop one night, and upon arriving in the morning struck a match to light it. There was a terrific explosion, and the shoemaker was blown out through the door almost to the middle of the street.

A passerby rushed to his assistance, and, after helping him to rise, inquired if he was injured.

The little German gazed in at his place of business, which was now burning quite briskly, and said:

"No, I aindt hurt. But I got out shust in time, eh?"

* * *

Marie—"When you spoke to papa did you tell him you had $500 in the bank?"

Tom—"I did."

Marie—"And what did he say?"

Tom—"He borrowed it."

* * *

"I'm not afraid of woman suffrage," said Little Binks. "My wife is a militant suffragette, but up to date I am Julius Cæsar in my house."

"I guess you are, Binks, I guess you are," said Wiggles. "There ain't many deader ones than Julius Cæsar in this world."

* * *

An irate patron of a restaurant called a waiter to him and said: "I found a needle in this soup. What does it mean?"

"Beg pardon," said the waiter, who used to be a proofreader, "that's a typographical error. It should have been a noodle."

A bride, anxious not to forget to order two chickens, repeated to herself while cleaning the breakfast table, "Grocer, chickens—grocer, chickens." The words got confused—so when she 'phoned she said, "Have you any nice young grocers?" "Why—er—yes," replied the astonished grocer. "Well," piped the bride, "send me two dressed—oh, no—better send them undressed. If my husband comes home he can wring their necks and the cook can dress them."

* * *

Scotch Sexton (who has shown old lady over church and followed her to the gate without getting a tip)—"Weel, ma leddy, gin ye find when ye gang hame ye've lost yer purse, ye'll mebbe mind ye didna hae it oot here."

* * *

The following is a recipe for a Coroner's Cocktail:

Mix three chorus girls with as many men and soak in champagne until midnight. Squeeze into an auto. Add a dash of Joy and a tipsy chauffeur. Shake well. Serve at 70 miles an hour.

* * *

Jeweler—"You say the inscription you wish on the inside of this ring is to be, "Marcellus to Irene?"

Young Man (somewhat embarrassed)—"Yes, that's right. But—er—don't cut the 'Irene' very deep."

* * *

"Why did you nickname your wife 'Circumstances'?"

"Because she is something over which I have no control."

* * *

"What do you mean by keeping me standing on the corner like an idiot?" demanded an angry husband, whose wife had kept him waiting to go shopping with her.

"Now, really, dear," she replied sweetly, "I can't help the way you stand."

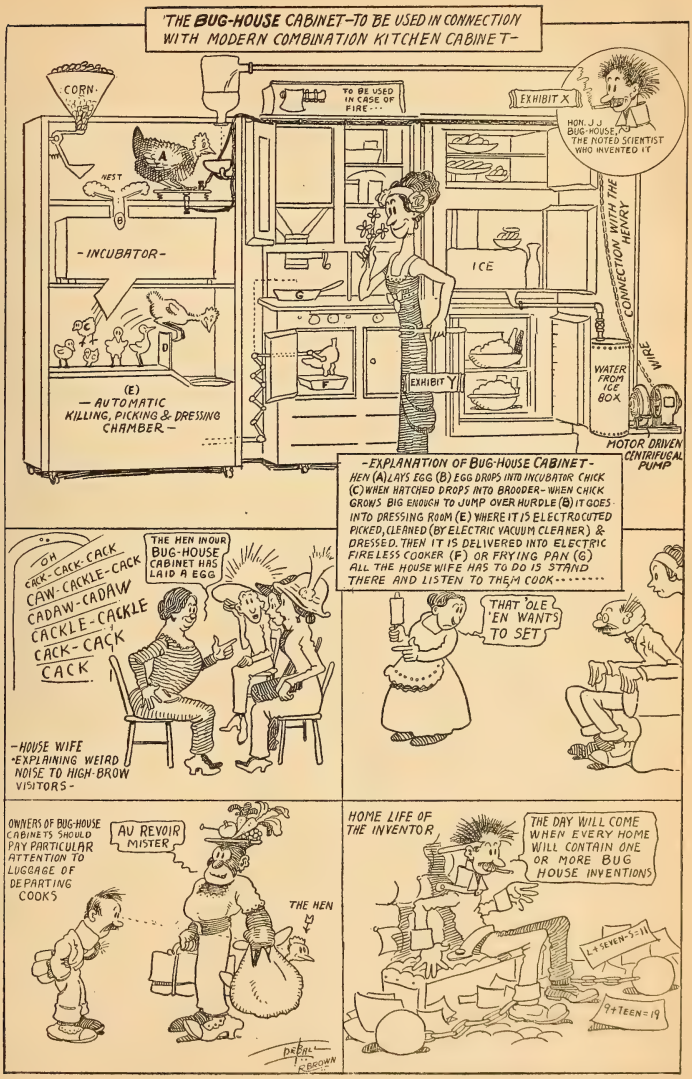
* * *

"What's the matter with your finger, old man? You've got it in splints."

"My oldest boy's ingenuity."

"How so?"

"He set a steel trap in his stocking to catch Santa Claus."


'THE BUG-HOUSE CABINET-TO BE USED IN CONNECTION WITH MODERN COMBINATION KITCHEN CABINET-
CORN
NEST
-INCUBATOR-
(E)
-AUTOMATIC KILLING, PICKING & DRESSING CHAMBER-
TO BE USED IN CASE OF FIRE---
EXHIBIT X
HON. J.J. BUG-HOUSE, THE NOTED SCIENTIST WHO INVENTED IT
ICE
EXHIBIT Y
CONNECTION WITH THE HENRY WIRE
WATER FROM ICE BOX
MOTOR DRIVEN CENTRIFUGAL PUMP
-EXPLANATION OF BUG-HOUSE CABINET-
HEN (A) LAYS EGG (B) EGG DROPS INTO INCUBATOR CHICK (C) WHEN HATCHED DROPS INTO BROODER- WHEN CHICK GROWS BIG ENOUGH TO JUMP OVER HURDLE (B) IT GOES INTO DRESSING ROOM (E) WHERE IT IS ELECTROCUTED PICKED, CLEANED (BY ELECTRIC VACUUM CLEANER) & DRESSED. THEN IT IS DELIVERED INTO ELECTRIC FIRELESS COOKER (F) OR FRYING PAN (G) ALL THE HOUSE WIFE HAS TO DO IS STAND THERE AND LISTEN TO THEM COOK.....
OH CACK-CACK-CACK CAW-CACKLE-CACK CADAW-CADAW CACKLE-CACKLE CACK-CACK CACK
THE HEN IN OUR BUG-HOUSE CABINET HAS LAID A EGG
-HOUSE WIFE EXPLAINING WEIRD NOISE TO HIGH-BROW VISITORS-
THAT 'OLE 'EN WANTS TO SET
OWNERS OF BUG-HOUSE CABINETS SHOULD PAY PARTICULAR ATTENTION TO LUGGAGE OF DEPARTING COOKS
AU REVOIR MISTER
THE HEN
DEBRIE
HOME LIFE OF THE INVENTOR
THE DAY WILL COME WHEN EVERY HOME WILL CONTAIN ONE OR MORE BUG HOUSE INVENTIONS
4+SEVEN-5=11
9+TEEN=19

Common Electrical Terms Defined

In this age of electricity everyone should be versed in its phraseology. By studying this page from month to month a working knowledge of the most commonly employed electrical terms may be obtained.

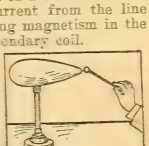
POTENTIAL DIFFERENCE.—Used to refer to the difference in electromotive force or pressure between two points. For example, the wire at the positive terminal of a 110 volt dynamo has a potential difference, when compared with the earth, of 110 volts.

POTENTIOMETER.—An apparatus for measuring with a galvanometer the electromotive force of a battery. Also used in wireless "hook-ups" as a variable resistance shunted across the terminals of the detector battery to reduce this voltage to a value slightly below the critical voltage of the detector. In the case of the electrolytic detector this is the voltage required to break down the thin film of gas which collects at the "bare point."

POWER.—The rate of doing work. In mechanics 33,000 foot-pounds or one horse-power is the unit. In the electrical field the kilowatt, 1000 watts, or volt-amperes, is the unit.

PRESSURE.—An expression used to refer to voltage or potential difference. (See Potential Difference.)

PRIMARY COIL.—The coil of a transformer or induction coil receiving current from the line or battery and thus inducing magnetism in the core and current in the secondary coil.



PROOF PLANE.—A small conductor, usually shaped like a disk, fastened to an insulating handle and used to take static electricity from a body so charged. (See cut.)

PRIME CONDUCTOR.—A metal covered sphere or other solid used to collect electricity from a static machine. The solid is usually mounted upon glass or hard rubber insulators.

PUSH BUTTON.—A switch for closing an electric circuit by pushing a button behind which are two springs which are thus crowded together, making electrical contact.

QUADRUPLEX TELEGRAPHY.—A system of telegraphy by which four messages, two in each direction, may be sent over the same wire at the same time.

RADIOGRAPH.—A photograph taken by X-rays. The object to be photographed is placed between the X-ray tube and the photographic plate. The X-rays cast upon the plate a shadow of the parts of the object, such as metal and bone, through which they cannot pass and the result is sometimes called a shadow picture. Such a photograph is also called a skiagraph.

RAIL BOND.—A heavy wire or metal plate electrically joining one rail to the next in an electric railway system. The bonding provides a good path for the current back to the power house.

RAT-TAIL.—A term in wireless telegraphy applied to the point where the leading-in wires are gathered together and passed into the building.

REACTANCE.—In an alternating current circuit the resistance, due to inductance and capacity, offered to the flow of current.

REACTION COIL.—See Kicking Coil.

RÉAUMER SCALE.—A thermometer scale used in Europe. The freezing temperature, as registered by the mercury column on this scale, is 0° and the boiling point is 80°.

RECEIVER.—The instrument in a telephone set which receives and converts into sound waves the current impulses governed by the sound impulse upon the diaphragm of the distant transmitter.

RECEPTACLE.—An incandescent lamp socket designed to be fastened to a flat surface, as the wall. Sometimes referred to as a wall socket.

RECTIFIER.—An apparatus to obtain direct current from an alternating current circuit.

RELAY.—A receiving instrument, common in telegraphy, consisting of two electro-magnets and an armature held back by a spring when the magnets are not energized. When current passes through the magnet coils the armature is attracted, closing a circuit upon a local battery and sounder.

RELUCTANCE.—The opposition which a piece of iron, steel or other metal offers to the passage of magnetic lines of force. Sometimes termed, magnetic resistance.

RESIDUAL CHARGE.—After a Leyden jar has been charged, then discharged and allowed to stand for a few minutes, a small second discharge may be taken from it. This second discharge is termed the residual charge. According to theory this residual charge is due to the displacement of the molecules of the glass dielectric when the jar is charged and to the resuming of their original positions when the residual charge comes forth. This theory seems to be supported by the fact that jarring the condenser or jar hastens the formation of the second or residual discharge.

RESIDUAL MAGNETISM.—The magnetism left in a piece of iron or steel after the magnetizing force, such as electric current or another magnet, has been removed. Sometimes termed remanence.

RESISTANCE.—Anything placed in an electric circuit or already there which opposes the flow of the current.

Popular Electricity
In Plain English
Henry Walter Young, Editor

Vol. V | August, 1912 | No. 4

CONTENTS

Page

To Electricity ..... Frontispiece
AN ELECTRICAL EMPIRE OF THE FUTURE... 305
Electric Stimulation for Babies..... 310
Up-to-Date Scrubbing 310
Powder Exploding Box in Stage Craft..... 310
THE WOOLWORTH BUILDING—KING OF SKY-SCRAPERS 311
Rush and Slack Hours in a Telephone Exchange.. 312
The "Trouble Hunter"..... 312
The Quartz Mercury Lamp in Medicine..... 313
Prospecting by Electricity..... 314
The Electrical Wizard of Willis Island..... 314
The Phonograph as an Automobile Alarm..... 315
A LONELY CABLE STATION IN MID-PACIFIC. By Edward Lyell Fox..... 316
HYDRO-ELECTRIC WONDERS IN CALIFORNIA. By Archie Rice..... 320
A Palace Garden Electrically Decorated..... 325
ADVICE TO FRESHMEN. By Francis C. Shenehon 326
Specifications for a Good Engineer..... 328
Hunts Diamond with Flashlight..... 328
Hamburg's New Railway..... 329
ELECTRICAL SECRETARIES. By "Contango"... 330
Whisper Girl for Theaters..... 333
New Electric Welding Process..... 333
Train Struck by Lightning..... 333
A Test for Radium..... 335
Execution by Electricity..... 336
An Electric Waffle Wagon..... 337
Radium in the Air..... 337
The Details of a Whitehead Submarine..... 338
Electrically Operated Floating Dry Dock..... 339
Good Light as an Asset..... 339
Presentation of Bust of Lord Kelvin..... 340
American Lamps Superior..... 340
Dr. Bell Reminisces After 35 Years..... 340
Fortuny Stage Lighting..... 341
X-Ray in Studying Athletes..... 343
The Electric Swan Boat..... 343
From Ancient to Modern Water Wheels..... 344
Insulation from Seaweed..... 345
TICKLING THE PUBLIC'S RIBS..... 346
Carnival at Nice..... 350
Moving Picture Theater in Trolley Car..... 351
Absorption in X-ray Tubes..... 351
Electrical Display Accompanying Mt. Taal Eruption 352
Electrifying a City..... 354
The Invention of the Acousticon..... 355
Saving a Power House from the Ice..... 355
ELECTRICAL COLLOIDS. By Dr. Leonard Keene Hirschberg 356

Electric Current at Work

The New Edison Rectifier. By Wm. H. Meadowcroft 358
Retouching and Printing Frame..... 359
Stranded Wire Tips..... 360
Auristophone Annunciator for Limousine..... 360
A Self Supported Telephone..... 360
Demand in India for Electricity..... 360
A Magneto Doorbell..... 361
Riddling Sand by Electricity..... 361
Automatic Welding Machine..... 361
Pressing Clothes by Magnetism..... 362
Ship Automatic Tell-tale System..... 362
Electric Heaters in a Water Tank..... 363
Electric Motor Operates Model..... 363
A Temporary Socket..... 363

Page

Portable Pump for Fire Fighting and Irrigation.. 364
Vibration Tachometer..... 364
ELECTRICAL MEN OF THE TIMES. Ray Palmer 365

Electricity in the Interests of Women

Camellia Thea and the Modern Tea Room..... 366
Thermal Storage Electrical Stove..... 367
Household Ozonator 367
THE AUTOBIOGRAPHY OF A FAN..... 368
Fan Facts 370
The Swinging Electric Breeze..... 370
A Home-Made Electric Lamp..... 371
A Cent's Worth of Electricity..... 371
Don't Neglect the Vacuum Cleaner Bag..... 372
Mechanical Refrigeration..... 372
Electricity Adds to Baby's Comfort..... 372

Junior Section

An Interesting Experiment in Magnetism..... 373
A Simple Ammeter..... 373
One of the Nobility and His Electric Auto..... 374
How Electricity Is Helping Me Through College.. 374
A Model Power Plant..... 375
Electricity in Flames..... 375
Electric Stimulation of the Senses..... 376
Formation of Imitation Crystals..... 378
Shocking Money 378
How to Remember Which Is the Cathode..... 378

Popular Electricity Wireless Club

ADVICE TO PROSPECTIVE WIRELESS OPERATORS. By James Mercer..... 379
Eclipse of Sun Affects Wireless Transmission.... 381
English Boy Scouts Studying Wireless..... 382
Questions and Answers in Wireless. By A. B. Cole 383
"Break-in" System 384
Novel Method of Suspending of Aerial..... 384

For Practical Electrical Workers

Electric Lighting Circuits. By Henry Clows..... 386
Getting Rid of the Tie Wire..... 388
How to Make a Resistance..... 388
Turns the Fan Off..... 390
Battery Holder 390
Wireman's and Engineer's Fuse Kit..... 390
Portable Street Light..... 391
Preventing Gravity Cells from Creeping..... 391
Keeps the Loom in Place..... 391
Ruby Lamp 391
A "White Hope" Fan Display..... 392
Fan Time Display..... 392

Science Extracts from Foreign Journals

Placing Platinum Wire in Quartz Tubes..... 393
Holland Fishing Boats Equipped with Wireless... 393
Lamps as Time-Limit Signal to Speakers..... 393
Wireless Telegraphy on Aeroplanes..... 393
Hotel with 200 Electric Clocks..... 394
Coating Balloons with Aluminum Powder..... 394
Peat Fields of Bavaria..... 394
Inspecting Eggs with X-Rays..... 394

Miscellaneous

INVENTION AND PATENTS. By A. P. Connor.. 395
New Books 396
From Diamond to Coke..... 397
New Discoveries Regarding Magnetic Metals.... 397
Electricity and Memory..... 397
The Production of Hydrogen..... 397
Short Circuits..... 398
Common Electrical Terms Defined..... 400

RENEWALS When your subscription expires, you will find a renewal blank enclosed here. You should fill out and return with remittance at once to avoid missing a number. Positively no copies will be mailed on any subscription after same expires unless renewed, and we cannot agree to begin subscriptions with back numbers. The date on wrapper of your magazine shows issue with which your subscription ends. The extension on this date to period covered by renewal is sufficient receipt. If any other is desired it should be requested at time of renewal.

CHANGE OF ADDRESS Notify us promptly of any change in your address, giving both the old and new location. Since our mailing list for each issue closes the 5th of the preceding month (i. e., list for February closes January 5th), changes received after the 5th must necessarily take effect with issue for second month following. Postmaster as well as Publisher should always be notified of changes in order to forward mail sent to old address.

ISSUED MONTHLY BY POPULAR ELECTRICITY PUBLISHING CO., Commercial Bldg., Chicago, Ill.
YEARLY SUBSCRIPTION, $1.50; CANADIAN, $1.85; FOREIGN, $2.25; SINGLE COPY, 15 CENTS
No additional copies will be sent after expiration of subscription except upon renewal.
Entered as Second Class Matter April 14, 1908, at the Post Office at Chicago. Under Act of March 3, 1879.

Copyright 1912, by Popular Electricity Publishing Co.

To Electricity

Ere the storm-clouds curled 'round an infant world,
Ere the air was cleft by a wing,
You encircled space in an endless race,
A wild, unfettered thing.
In creation's art you wrought your part,
Subject to Nature's skill;
From zone to zone, a power unknown,
Unshackled by man's will.

On a summer eve strange scenes you weave,
Where the fleecy clouds pile high;
When your lightnings shift from rift to rift,
As you play in the twilight sky.
Oh, there's grotto and wall, palace and hall,
Quaint ships on an ocean blue,
Your flashlights run like molten sun
Blent with the sea shell's hue.

But you come to our eyes in another guise,
Where motor harnesses bind;
And the ocean's wide sweep and the mountain steep
Cannot measure your worth to mankind.
Oh, the matchless speed of the winged steed,
Needing not bit nor spur,
Where the broad belts slant and the engines pant,
And the spindles reel and whir.

—RENICE RADCLIFFE

Popular Electricity
In Plain English

VOL. V AUGUST, 1912 No. 4

An Electrical Empire of the Future

Dwellers in the East, the South and in the great Middle West hear often of the "Empire" which is being built up beyond the slopes of the Rockies. Ordinarily they pass over the term lightly as a pet expression—a slogan, if you please, of an enthusiastic people in a new country. A few, comparatively speaking, of the millions who live in our flat lands and the aged and lowly hills of the Appalachians, which we are pleased to call mountains, cross the Great Divide and passing on through the Cascades, find in reality an empire of wonderful natural resources, of human grit and great accomplishment —and it is significant that a large percentage of them never come back. "If we can have them for one year they are ours for good," say the people of Seattle and Portland, and the casual visitor sees no reason to dispute their boast, for no doubt the climate, the rivers and the mountains, the almost tropical luxuriance of the vegetation and the activity and amazing growth of their very modern cities are already working their subtle influence upon him.

It was into this country—to Seattle—that the delegates to the National Electric Light Association made their way in June, to hold the annual convention. Some mention of this event was made in the June issue. It was a long journey for most of them. Some came on the Red Special DeLuxe and the Pink Special all the way from New York; others from Chicago on the Green Special, via the Canadian Rockies, or straight through on the Orange Special. Then there was the Purple Special from St. Louis and the Golden Poppy Special from Los Angeles and San Francisco.

To the electrical men especially did this country seem to come up to its

Copyright by Romans Photographic Co.

THE BUSINESS CENTER OF SEATTLE. IN THE DISTANCE IS MT. RAINIER, WHOSE ETERNAL GLACIERS FURNISH WATER SUPPLY FOR SOME OF THE HYDRO-ELECTRIC DEVELOPMENTS

name—an empire above all others in its electrical possibilities; for the glacier fed lakes high up in the mountains and the furiously running streams mean electricity without coal. In other words, current can be produced cheaply and used profusely in a manner that makes these Western cities blaze at night almost like great amusement parks.

What the citizens of Seattle did not do for the visitors was not worth doing. They consider their city a gem—an electrical one—and they like to show it to people and explain how wonderful has been its growth, and discourse upon the possibilities which the future holds. So after four strenuous days of convention work dealing with the technicalities and commercial phases of the electrical industry, the visitors were permitted to view some of the great natural sources of energy from which the city of Seattle derives the current which it uses so lavishly—being taken by special train far back up into the mountains where the great power plants are located.

It may be said at this point that the system of The Seattle Electric Company includes railways and lighting and power facilities, serving a population of 245,000 people. There are 193 miles of track, with 550 cars, and in 1911 101,200,000 passengers were carried. Current for light or power is provided for 15,000 of the city's homes and business houses, there being 1,274 commercial arc lights, 75,178 incandescent lamps and 13,547 horsepower of motors on the system.

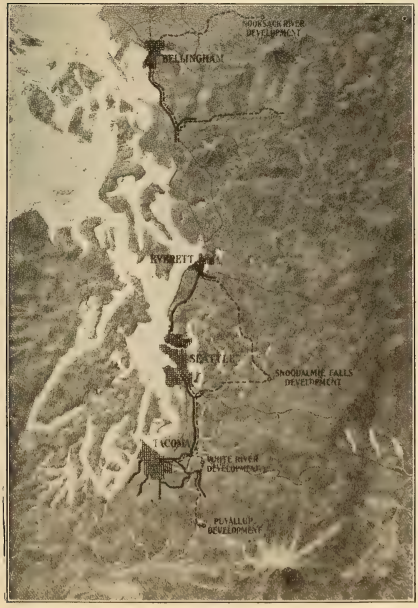
Three car lines reach the shore of Lake Washington on the east, where the company maintains large parks that play an important part in the outdoor life of the city. In winter as well as summer these parks are enjoyed by thousands of patrons.

Madison Park is the terminal of the Madison Street Cable Line, which pierces the center of Seattle. On the

southeastern shore of the lake, at the end of the Yesler Way Cable Line is Leschi Park, and between lies Madronna Park on the Madronna Park Line, with cable connections on James Street in the heart of the city. On the north, the Seattle electric system connects with the interurban line running 22 miles to Everett and on the south with the Puget Sound Electric Railway extending 36 miles to Tacoma. This great system and the power plants which supply it have been developed by the Stone & Webster Engineering Corporation of Boston.

To meet the demand, plants have been built and are now operating on the White River, the Puyallup, the Snoqualmie and the Noosack. The capacity of these plants is over 80,000 horsepower, or about 60 per cent. of all developed power in the district. The Noosack is as yet a separate system, to the north of Seattle, with a power plant and 40 miles of transmission lines running to Bellingham.

In the foot-hills of Mt. Rainier, 1,700 feet above sea level, is located the headworks of the Puyallup development. The Puyallup River rushes in a series of cascades through a deep rocky gorge to the northwest. For ten miles along the southern face of the gorge, higher and higher above the river, runs a timber flume carrying a standard gauge track for gasoline inspection cars. Through this flume the water flows evenly from the intake to a large reservoir above the power house. Then from a concrete forebay built within the reservoir, it is led several hundred feet in pipes to the brink of the gorge, where it enters four steel penstocks and drops 872 feet to the power house at the river's edge. The power house contains four units of 3,500 kw., or approximately 19,000 horsepower.



THE PUGET SOUND COUNTRY—SOLID LINES SHOW RAILWAYS; DOTTED, TRANSMISSION LINES

Thirty miles away, to the east of Seattle, the Snoqualmie River drops over a perpendicular cliff 270 feet high. Just above these falls are the dam and intake of the Snoqualmie development.

A low, rock filled, timber crib, part of a previous development, diverts the flow to a concrete intake leading to a tunnel, 1,000 feet long and twelve feet in diameter, cut through the rocky crest of the hill. The tunnel emerges from the hillside in a concrete forebay cut in a jutting shoulder of rock looking directly down upon the power house. Through a penstock, 470 feet in length, the water goes from the forebay down the steep hillside under a head of 284 feet.

To get the machinery and supplies for this development onto the job, a spur was run from the tracks of the Great Northern Railroad, on the south side of

SECOND AVENUE AT NIGHT—SEATTLE'S "GREAT WHITE WAY"

the Snoqualmie, to a car ferry above the falls. The standard railroad cars, loaded with equipment, were switched from the main line, ferried across the river, hoisted up one incline railway and lowered down another by electric hoists to the power house.

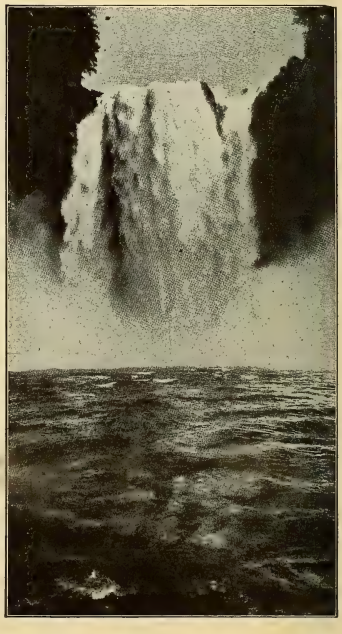
The present installation consists of one 10,000 horsepower Francis type turbine direct connected to a 7,000 kw. generator, but the ultimate development will have three such units and three penstocks. Power is transmitted to Seattle, Tacoma and Everett.

On an elevation, 24 miles southeast of Seattle, and ten miles east of Tacoma, is Lake Tapps, the main storage reservoir of the White River Development. It lies in a large, natural basin and around and beyond it is a plateau, stretching away on the east to the Cascade Mountains and the upper reaches of the White River.

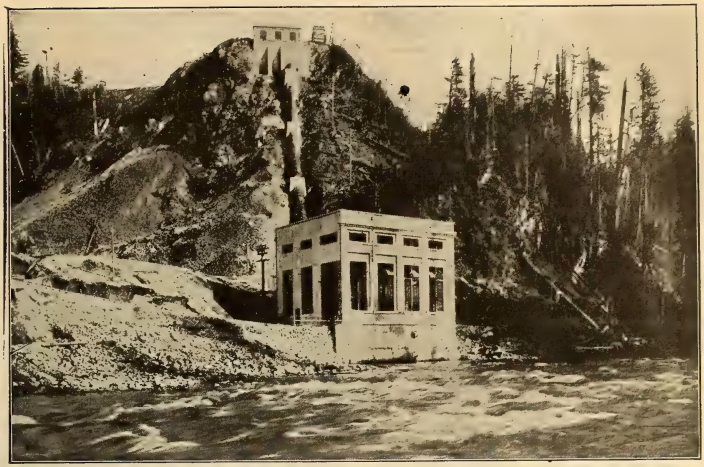
A mile west of the lake this plateau begins to drop abruptly to the floor of the White River Valley, 500 feet below.

The development has taken advantage of this situation by diverting the White River at a point seven miles southeast of the lake and leading part of its waters through flumes, artificial basins, canals and natural valleys across the plateau to the lake, and thence by canal tunnel and penstocks to the power house.

The storage capacity of Lake Tapps is about 2,250,000,000 cubic feet, a reserve that gives the White River Plant the unique distinction of being able, if necessary, to operate at nearly its full present capacity of 40,000 horsepower for a month on storage alone. The plant balances the load on the entire system of developments, and, since its operation



SNOQUALMIE FALLS IN 1909. WITH A SHEER DROP OF 270 FEET, IT MADE POSSIBLE TWO GREAT PLANTS WHICH FURNISH LIGHT AND POWER TO SEATTLE



ONE OF THE PLANTS AT SNOQUALMIE. HERE THE WATER FALLS UNDER A HEAD OF 284 FEET TO THE TURBINE AT THE RIVER'S EDGE

began, the steam relay in Seattle has been practically idle.

This in brief is an outline of the water power developments of the Puget Sound District as it is known, and which supply Seattle with the greater part of its

ELECTRICAL EXHIBITION IN SEATTLE ARMORY, THE SCENE OF THE NATIONAL ELECTRIC LIGHT CONVENTION

current. Seattle maintains stoutly that it is *the* "City of Light," though there are numerous other centers that aspire to that distinction. There certainly *is* light in Seattle and lots of it, and electricity is used for power as freely as for glowing filaments. It takes power to run street cars in Seattle, for when you are not going down hill, you are climbing most discouragingly up hill—there are no level stretches. Some of these hills used to be the limit, until some one hit upon the idea of setting up huge electric driven pumps which drew water from a lake and squirted it against the hills with terrific force, washing them away, a river of mud, into the lake and making new land. To make itself big and bustling and modern in every way the city has had to fight and fight hard against some of these adversities of Nature, but in doing so has turned against Nature her own most powerful weapon—Electricity.

Electric Stimulation for Babies

Mr. T. Thorne Baker, the electrical expert connected with *The Daily Mirror,* London, who recently made some experiments in raising chickens under the influence of high frequency current, now proposes to do the same thing with babies.

"No kind of food seems to do some weakly babies any good," says Mr. Baker. "I, as recently stated in *The Daily Mirror,* propose to use an electrically charged cot, in which the baby is put to sleep for about 20 minutes at a time.

"The physician is at present experimenting on little animals, such as guinea pigs, and in a few days we shall begin with the babies."

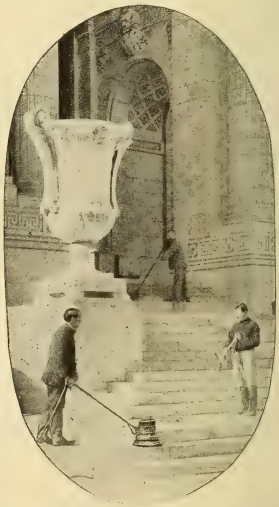
Mr. Baker's intended experiment is to place babies near high frequency currents, which would be switched on while the child sleeps in a little bed, placed inside a special coil.

"The result," he said, "will be that while treatment is in progress the electro-magnetic vibrations will pass back and forth right through their bodies."

Up-to-Date Scrubbing

A strong man behind a scrubbing brush can do excellent work, but in these days of special attention to the relative cost of work it has been found that this is an expensive method.

The illustration shows an International electric scrubbing machine at work on



SCRUBBING THE STEPS OF THE NEW YORK LIBRARY

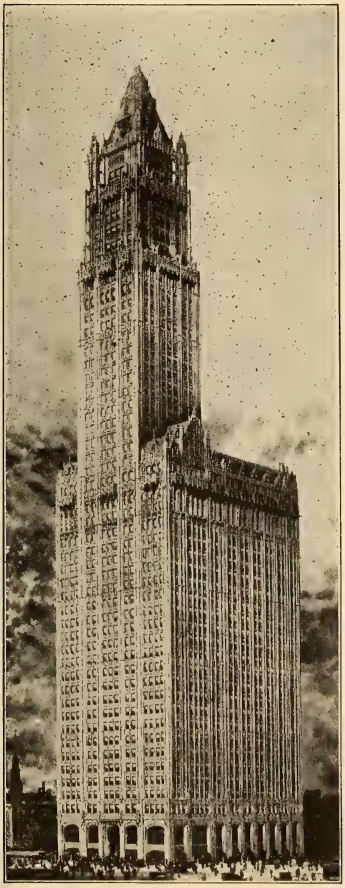
the steps of the New York Public Library. The use of the machine, which weighs only 75 pounds, results in great saving of time and labor.

Powder Exploding Box

In the article on "Some Secrets of Electrical Stagecraft," July issue, the drawing of the powder exploding box shows same with a cover in place. The box should obviously have been shown without a cover. With a cover on the explosion would be *real.* Smokeless powder should be used, as black powder would make smoke enough to cause choking and coughing in the audience.

The Woolworth Building—King of Skyscrapers

In the erection of the world's newest skyscraper, the Woolworth Building in New York, no other power than electricity is being used for operating the engines that hoist the thousands of tons of steel and other material that are being put in this 45-story, 750-foot high building. By the fall it will be completed, towering 50 feet over the Metropolitan Tower, the present king of skyscrapers.



BY FALL THIS 750 FOOT BUILDING WILL BE COMPLETED, TOWERING 50 FEET ABOVE THE METROPOLITAN TOWER, PRESENT KING OF SKYSCRAPERS

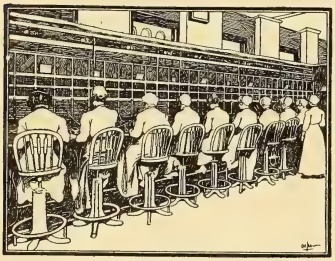
When completed there will have been put into the Woolworth Building 130,000 tons of material. There are six 80-horsepower hoisting motors and another of 40 horsepower, and when their work is completed they will have hoisted 21,000 tons of steel.

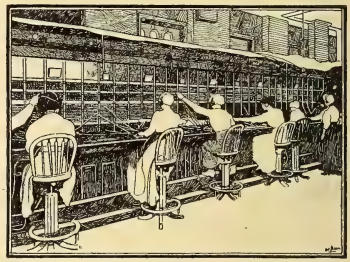
Seventeen million bricks are being used which weigh 42,500 tons, the glazed terra cotta weighs 7,500 tons and the fireproof flooring and arches weigh 32,000 tons more. All of this material is carried to the upper floors on freight elevators and hod hoists. There are ten of these elevators, operated by 40- and 50-horsepower motors. The hoisting machinery is set on one of the lower floors and a system of bell signals tells the operator when to start and stop his car. The concrete is also carried on these hoists after having been prepared in the sub-basement. Four motors of fifteen horsepower each partially mix this material. After it has been delivered to the masons on the upper floor more water is added to bring it to the right consistency. This water is carried through a temporary installation of plumbing that reaches hydrants to every floor, and is kept in circulation by two fifteen-horsepower pumps, while a third pump of 50 horsepower is required to keep the cellar dry. For the compressed air required to hammer the heads of the rivets in place air compressors of 50 and 25 horsepower are required.

Two hundred arc lights and a thousand incandescent lamps provide light for the workmen on the darkened floors. Current for the lights and motors is supplied by the New York Edison Company. There are fourteen meters on the service board and a force of six electricians keeps the wiring up to the progress.

Rush and Slack Hours in a Telephone Exchange

During the rush hours of the day's work every "position" in a great telephone exchange requires an operator.





WHAT RUSH AND SLACK HOURS MEAN IN A TELEPHONE EXCHANGE

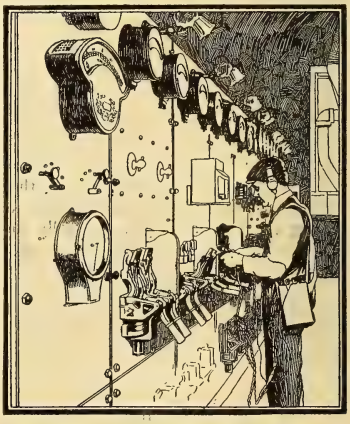
Calls are coming in at a rapid rate, and it is as much as one girl can do to take care of the few hundred incoming lines which terminate on the board directly in front of her.

When the lull comes at the end of the day half as many operators will do, and in the middle of the night only a few are required, who walk back and forth in front of the long board making the few scattering connections. The two drawings illustrate the difference between the "rush" and the "slack" hours. In the latter case the operator takes care of a position on each side of her usual one, making a rather long reach.

The "Trouble Hunter"

The electric "trouble hunter" is a unique apparatus used by the modern electrician for locating all sorts of aches and pains in nearly every kind of electrical device on the market. It is to the testing engineer what the stethoscope is to the doctor who makes a specialty of heart disease. It correctly diagnoses cases of short circuit, open circuit, grounds, and nearly every ailment that a piece of electrical apparatus is heir to. The appliance is easily portable and consists of a small induction coil, condenser, and batteries in a case carried on the back. Two flexible wires lead to two insulated copper terminals, and by applying these to the parts of the motor or switchboard the operator notes by the sounds in a receiver clamped to his head what the trouble is, and by a systematic search finally discovers the trouble and remedies it.

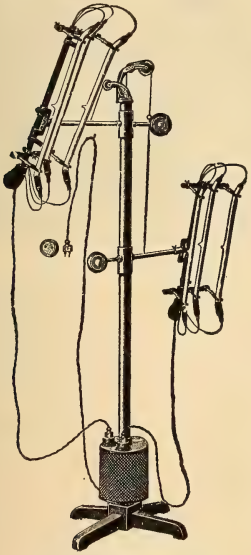
The great advantage of this device over the ordinary testing set is the fact that it requires no one to turn a magneto crank, and the entire apparatus is light and easy to carry.



EXPLORING WITH THE TROUBLE HUNTER

The Quartz Mercury Lamp in Medicine

Dreaded germs lurk in dark places. Sunlight destroys them. For those reasons health flourishes out doors while germs and disease are found in dark, dismal places. Sunlight destroys germs because it contains, besides light and heat, ultra-violet rays which have wonderful medicinal properties. These rays are destructive to animal tissue and for that reason care must be exercised in not exposing parts of the body, especially the eyes, to ultra-violet light of appreciable intensity.



QUARTZ MERCURY LAMP

It is the ultra-violet light in sunlight which tans exposed portions of the body. On exposure of the eyes to the light from a quartz mercury tube or a carbon arc without a globe intense irritation will result. This irritation does not appear until some time after the exposure, and for this reason unusual care is necessary.

All of us are familiar with the mercury vapor lamp commercially known as the Cooper-Hewitt lamp. This bluish-green light comes from the luminous vapor contained in the highly evacuated glass tube. A modification of this ordinary glass mercury-tube lamp is used for medicinal purposes. For the glass tube is substituted a clear quartz tube which is transparent to all the ultra-violet rays. Glass is opaque to these wonderful rays just as wood or metal is opaque to ordinary light.

One form of the quartz mercury-vapor lamp is shown in the figure. It is called the Uviol quartz lamp. The tubes are held on arms and the light can be concentrated on any portion of the body. Skin diseases are especially treated with satisfactory results, and by this and other apparatus, ultra-violet light is beginning to rival the wonderful X-rays and the mysterious element radium in medicinal practice.

Prospecting by Electricity

A demonstration of a system of ore finding by electricity was made at a mine in North Wales, where it was shown that a hidden vein of lead ore could be clearly located by this means.

This mine, the Telacre, is situated at Prestatyn, and for some while it had ceased operation for the reason that further working would be attended with considerable loss. The tests applied foretold the presence of ore in new places and in the deeper workings, and borings that were made corroborated the predictions of the instrument.

At another mine, at Cwmystwyth, similar success was had, a lode of lead and blende being found in an unsuspected place. The system seems to depend upon the production of electric waves which are affected by the near presence of metallic ore in the ground, the position being judged by means of that wonderful detector of delicate sounds, the telephone receiver.

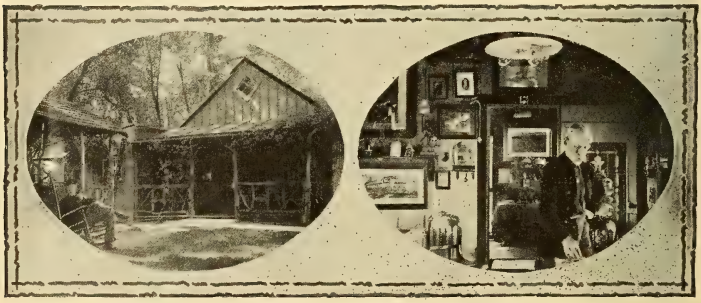
The Electrical Wizard of Willis Island

Close to the Pennsylvania shore of the Delaware River, about five miles above Trenton, N. J., and two miles below the historic Washington Crossing, lies a beautiful island. Here James Willis has lived alone with Nature for the past 28 years. Here he built with his own hands the first bungalow on the river, and has equipped it from time to time with all the up-to-date conveniences of the city home.

Gifted with a natural bent for scientific work, he has spent his spare moments in fitting his home with all manner of ingenious electrical contrivances, so that it is a veritable house of magic and mystery. There are in all about 150 connections, and when the switches are closed, it is almost impossible to move a muscle or touch a thing without receiving a shock or turning on the lights or ringing an alarm bell.

In all kinds of weather, winter as well as summer, Mr. Willis has lived on the island. Between April and October he entertains about 2,500 people, and his registry book shows men in all walks of life throughout the country. To visit the bungalow you go down to the Pennsylvania shore of the Delaware River and hail "Jim Willis." In a few minutes, if he is at home, he comes for you in a boat, and after a pleasant greeting rows you over to the island.

The island contains about ten acres and is densely wooded. Once there you walk up under broad spreading trees to the house. And what a cozy little place it is!



THE ELECTRIC WIZARD OF WILLIS ISLAND AND HIS BUNGALOW

You are invited to enter. The house is only one story, but everything spells solid comfort, and as you cross the threshold into the living room you are most agreeably surprised. There are easy chairs, a large center table covered with the latest books and magazines, electric lights, a telephone, an electric heater—everything, in fact, to make life comfortable.

After you have taken it all in, the fun begins.

On each side of the room you may notice, if you are a close observer, two switchboards. One controls a 600-volt connection with a trolley line on the Pennsylvania side, which furnishes power for the lights, heater and other devices. The other controls a network of apparatus operated automatically by a system of over 100 dry cells. There are 150 connections in the house.

Mr. Willis moves a few switches, and you find you can scarcely stir or touch a thing without closing an electric circuit. Immediately the lights go on and

a gong rings. If you pick up a book, a pipe, or lift the lid of his tobacco jar, you start an alarm. You cannot sit down, move a shade, open a window, turn a door knob, or take down the broom without an electric alarm ringing. You can't even take a pin from his pin cushion, or a toothpick from its holder, nor can you even turn the water into the lavatory without the same result.

The bedroom offers more surprises. It looks like any ordinary cozy sleeping apartment, but here, too, his electrical science has been employed. When the proprietor lays himself in bed all the curtains come down with a click and the lights go out automatically, without the touching of a switch. As soon as he raises his head from the pillow in the morning the lights and window shades go up again. Every part of the house is fitted up in this manner. At night time, when the curtains are pulled down to keep outsiders from seeing in, the lights go on automatically as soon as the curtains start to lower.

The most unique and interesting piece of work in the whole place is an electrical alarm clock. Mr. Willis made this from a tomato can, a small desk clock, and part of an arm of a pair of drawing compasses.

The clock is supported face up on a vertical rod. The can rests upon the face of the clock and is so attached to it that as the hour hand moves the can rotates on its axis, making one complete revolution every twelve hours. Around the surface of the can, near the top, runs a paper band, which is divided into twelve equal parts to represent the hours.

In front of the clock is a vertical hand. The compass arm may be attached to the top of the can like a clothespin. Place it above any hour mark, and when that mark gets around to the stationary hand again the compass arm touches a projecting rod, closing the electric circuit. Then the lights all go on, the shades are all automatically lifted, and a twelve-inch gong sounds loud enough to be heard across the river. It is a most efficient alarm clock.

Mr. Willis himself says the house is one of the most perfect burglar-proof structures in existence, for the very instant anything is touched this enormous gong sounds, or the lights are lit, or both, and if it is an intruder at the window, the curtains rise, showing who the miscreant is.

The Phonograph as an Automobile Alarm

A decided innovation in automobile alarms is promised through an invention patented by Joseph H. Erickson, San Francisco, Cal. The device is a phonograph so constructed that it may be attached to the front of an automobile. Spoken or musical warnings, according to the fancy of the owner, may be used. By pressing a foot lever or a push button the alarm may be repeated as often as desired.

A Lonely Cable

An emerald set in a pear-shaped lagoon, a ring of pink coral, a shimmer of white where the beach slides down to meet the chameleon sea, the tops of cocoanut palms moving gently, a jumble of low roofed houses, two windmills spinning lazily in the breeze, and beyond, the blue tropical sky reaching out to meet the vague horizons—that is Midway Island, a lonely cable station in mid-Pacific.

If you look upon the charts, you will see that it is half way between California and China, half way between Australia and Alaska. And if at the risk of inaccuracy you care to continue the alliteration you may say, half way between Vladivostok and Valparaiso. Of course Midway is the most important station on the Commercial Pacific cable. It is the place whereon rests the long arm of Electricity while reaching to connect two worlds. It is the border of the Western Empire; at the gate of the mystic Orient. It is where Yesterday going West meets Today coming East.

Here is the little hut that throbs with the news of the world—and does not care. Here are the cable operators, silent men, watching day and night the incessant swing of the Morse code. Here unreels the panorama of the world—its tragedies, its joys, its commerce, its affairs of state. From the East it turns, a kaleidoscope, the siphon recorder. And always there are men waiting to read it, to relay every dot on the last leap under the seas to the West. And from the West it comes to the little hut, faint and weak, weary with its long race, only to be caught and hurled toward the China Seas. A lonely little island, to be sure, but wonderfully important—an outpost on the borders of two empires.

Few people know it exists. Only the cable men and those who have sailed the South Seas look intelligent if you mention the word Midway. Most people think you're talking about some World's Fair. Which is to be expected.

Life at the little station is loneliness sublime. Recently Midway came into the news. People saw its name buried in a little paragraph in the newspapers. The Pacific cable had broken down. The break was at Midway. A cable ship had set sail from Seattle to repair it.

Then Midway was forgotten. In the little hut the signal began to sound. East met West again and Midway vanished from the thoughts of men. Still the siphon is swinging back and forth in the isolated hut; still the news is being caught and sent racing on under the seas.

On the Midway sands, clear white, the product of the leaching of the dead coral by the rains, the sun blazes eternally. It blazes the same, day after day—just a glaring rim that seems to run down to the sea to get cool. And on the people of the island the men and women, a score of them, the sun has left its mark—the

Station *in* Mid-Pacific

By
Edward Lyell Fox

awful mark of the tropics. It has made their faces brown and drawn, their eyes a little sunken, a little expressionless. Most of them wear thick blue goggles. Otherwise they would go blind. All variety has gone from their lives. Always the sun burns fitfully; always when the rain comes it comes at the same time; always when a breeze blows it blows from the same corner of the horizon; always when the sand, picked up along the beach by some sudden gust, whirls and dances, it does the same dance that it did yesterday, today—tomorrow, forever.

Always, Electricity, the voice that connects Midway with the outer world, talks the same way. Even when it tells of great news—perhaps of an empire being overturned—it never lifts the inflection. And so when day after day the whole world passes through a little hut, those in the hut are apt to become weary. To them it is an old story. They are like a newspaper man, growing cynical. There can be no change, in Midway.

Only four times a year is the monotony broken. Even then it's the same. The break comes on certain days in the year. Every three months the sails of a schooner appear in the lagoon. It is the supply schooner from Honolulu, bringing mail from the home, newspapers, food. Sometimes a new operator is swung over the side of the schooner. Perhaps he comes to take the place of one of those who, crazed by the monotony of the place, must return home. Perhaps he just moves in a routine of things, coming to relieve a man whose turn of service is ended. But, strange as it may sound, the cable company will tell you that they have more applications than they can fill, for berths at Midway. Every operator must sign a five years' contract, but if the solitude of the place overcomes him, there is always someone in the States eager for his post.

Only the other day I met a man who had been to Midway. From him I learned something about life on the island, some of its wild history and a place that he called "The Great Bird Park of the Pacific." He told me that the present population of the island was 23 persons. I asked him to enumerate, and he said they were the superintendent

HERE UNREELS THE PANORAMA OF THE WORLD

of the cable station and his wife, a chief operator, also married, a physician, a crew of operators and a few laborers. He also added to the list two donkeys, two cows, and two canaries. This reads like the passenger list of the Ark, but it's just a coincidence that the animals were dealt in pairs.

Then I asked him how it was that Midway came to be selected as the cable station. But before answering me he told me something about the wild history of the place. It seems that from the time men first sailed the tropical seas Midway has been a graveyard for their ships. Like all uncharted and unlighted islands, its beach is strewn with the broken bones of many sailing vessels. Just beyond the cable station one may find the remains of some Japanese junk, dry planks bleaching in the torrid sun. Further on are the signs of other wrecks, jagged spars sticking up out of the sand —the shafts of the graves.

And the island has its stories of these wrecks. There is the tale of the *Wandering Minstrel,* Swiss Family Robinson sort of a story, with Captain Walker and his family living on the island after the crew had died of scurvy. For fourteen months they lived on the fish they were able to catch, the birds they killed and such eggs and fruit as they found. Then a schooner came from Honolulu and took them off.

And there is the story of how the Pacific Mail Company, wanting a coaling station, annexed the island, naming it Midway; how the *Lackawanna,* commanded by Captain William Reynolds, landed marines, erected a shed and stored a little coal in a neat pile. For this exploit was only an object lesson for old

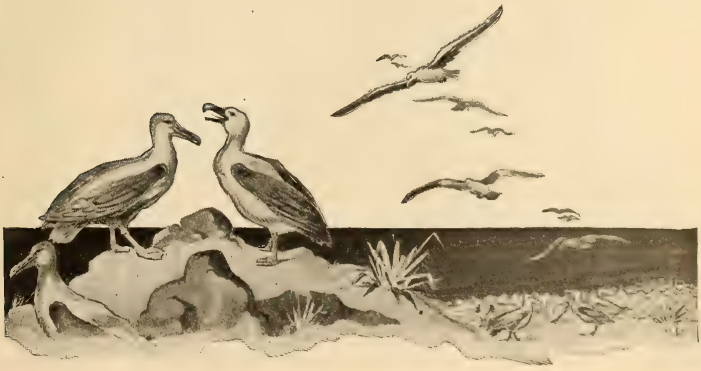
King Kamehameha V. This Hawaiian monarch, forgetting all that the Pacific Mail had done for him, tried to collect high revenue for a coaling station at Honolulu. So the company organized the reserve at Midway just as a blind. And seeing his country apparently about to be cut off from the regular route of travel, the old King came to terms. Today the pile of coal may still be found at Midway. But washed by the tropical rains, neglected and forgotten, it is just a pile of soft dark rock, brittle like coke, but with all the combustion gone from it.

In due time, however, the seizure by the *Lackawanna* was pronounced unconstitutional.

Then came Kalakaua, the dreamer of the South Seas, who proposed an empire of the Pacific with Hawaii at its head. Accordingly he annexed Midway and other adjacent islands, but that was all. The empire never emerged from the mists. Finally Kalakaua ceded the island to this country and Congress accepted. And so Midway basked peacefully in the sun until the *Nero* reached it during the survey for the American cable across the Pacific. That was in May of 1899. Four years later the cable was laid and Midway, the desolate speck, had become an all-important link in the electrical band around the world.

And then the man who had been there told me about the "bird park," a surprising preserve of glistening sand, coarse grass, and blue sea. He told me that from Midway, extending toward Nihoa, the nearest Hawaiian island, lies a national sea bird preserve—1,500 miles of water and sand, where the albatross dance, clumsy things, yet bending to their minuets with tropical rhythm. He told me that it was a place patroled by a revenue cutter. I think he called the boat the *Thetis*. I know he said it was busy rounding up Japanese poachers who continually invaded the preserve. He said that the park contained a number of birds beyond reckoning. He called them a million, merely as a unit of reckoning. He could have said quintillion and he wouldn't have exaggerated.

If we are to believe the superintendent, life there is very satisfactory. It always is to the man who yields to the tropics, lets the sun get into his head—becomes what Jack London calls a "Son of the Sun."



Hydro-Electric Wonders in California

By ARCHIE RICE

This is the third article of the series. The first described how a famous gold bearing river was diverted to produce hydro-electric power for the operation of huge gold dredges. The second told of the original Yuba River project and its relation to the deep gold mines of the famous Mother Lode. The fourth and last article of the series, which will appear in an early issue, will present one of the largest installations on the West Coast, with its 40 miles of flumes and ditches leading the water to its final terrific drop of 1,450 feet, or over a quarter of a mile.—Editorial Note.

CHANGING MOUNTAIN SNOWFLAKES INTO CITY LIGHTS

Fred is a portly chap, ruddy and English.

We were standing on a street corner at the top of one of San Francisco's dozen high hills.

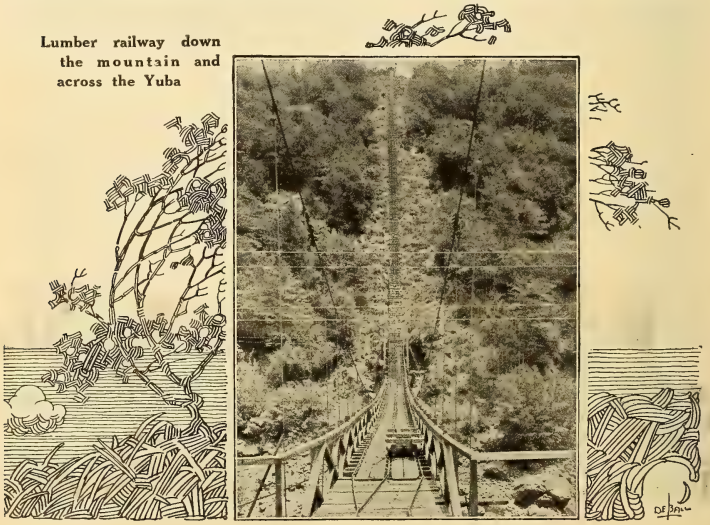
"I say, what's all that—the lights?" inquired Fred, with a forward sweep of the hand.

"That's a 20-mile stretch of cities and towns along the east side of San Francisco Bay. At the extreme left is Richmond, an oil refinery and manufacturing city of 10,000 people; then the little town of Albany; then the hillside residential city of Berkeley, with its 41,000 people, and the great state university with about 3,500 students; then the city of Oakland, with its 150,000 people, and then the quiet community of Alameda, where dwell about 20,000 people."

"But the lights?" persisted Fred; "they appear to be electric, and quite like a million of them."

"Those lights," I explained, "are made from mountain snowflakes."

"In the mountains off behind all those



Lumber railway down the mountain and across the Yuba

lights," I continued, in answer to an amazed query, "are the generating plants, converting snowflakes into incandescent lights for the coast cities."

Because he said he would like jolly well to see it done, the next forenoon we started to see the source of all this light, first by ferry across the three mile stretch of waters to the projecting Oakland pier. The ferry boat disgorged its throng of humanity, streaming forth like a dark flood that had burst through the restraining dam in three great openings. Fred and I were carried along with the current to a score of local and suburban and main line trains waiting on parallel tracks under an enormous glass roofed shed.

After towns and farms and factories had been rapidly thrust past our windows for an hour, during which Fred critically studied a copy of the *London Illustrated News,* I interrupted him in his devotions.

"See that high skeleton tower on that hill over there across the water? See those wires crossing to our side? This is the upper end of San Francisco Bay. I want you to get a good look at those wires. That is the longest aerial cable in the world. Each of those wires is a metal rope almost an inch in diameter. There are four of them. They stretch a distance of more than 6,000 feet, which is something more than a mile. The lowest one is 206 feet above the high water surface of the bay. And through three of them there is constantly flowing, day and night, electric current at a pressure of 60,000 volts. That is what carries lights to those cities you saw last night and power to all the factories we passed."

Toward evening we got off at a little town called Colfax, possibly 2,500 feet above the waters of the bay. There a tiny train was wheezing impatiently on a siding. We boarded it and the little cars rocked to the vibration of our steps. Then we wound through wooded ridges and crossed deep ravines on trestles that were like huge stilts. The front end of the train shrieked and shrieked, and the piercing notes echoed from afar, flung back by the mountain ridges and the depth of the cañons.

"Nevada City!" announced the brakeman finally, and he commenced turning down and blowing out the little oil lamps.

We were inside a hollow globe. Above us, quite near, was the curve of the sky studded with stars. About us, like a deep dish, rose the slopes of a concave town, aglitter with hundreds of electric lights.

Before five the next morning we were on the road in a mountain rig, behind two rangy horses. We passed great deep mines in the gray of early dawn, and heard the rumbling of the incessant tramp of the ore crushing stamp mills. Four thousand feet down in the earth men were still working on the night shift, toiling by electric light. The ore

End of the Flume and the final drop to the Colgate Plant

cars and the hoists and the stamp mills were moving by electric impulse.

The road went down and down for a mile and then up and up for another mile, but always down or up.

"These roads don't seem to be paved at all," he observed.

A half hour before noon we came to the top of a long wooded ridge. Far down in a ravine was another river. We unhitched the horses and left them in a shed where there was some hay.

"And now what?" ventured Fred.

"A little stroll down to the power house. It's only about a mile. But it's too steep for a wagon road."

"Look!" exclaimed Fred; "there's a bath house on the creek down there! You know, I'd like jolly well to have a bath after that dusty ride."

"You mean that long white building on the edge of the river?" I asked. "Well, that little thing is the length of a city block, and it's 40 feet wide, and full of thousands of dollars' worth of big electric generators and transformers, with sets of giant waterwheels down in the basement. It's built of solid granite and lined inside with cement and braced and girded with steel bars. That little creek you see way down there is the Yuba River. Those streams you see spurting out from the building would tear down a whole London block as if it were so much beach sand piled up by children at play.

"That cleared swath stretching off there to the left along the river is the route of one of the power lines, the one that we saw crossing that strait by the longest aerial span in the world. Your cute little bathhouse down there is a mile from here, and in it is constantly being generated nearly 20,000 electric horse-power.

"This pole right here by us carries some of that power back to help run those mines over at Nevada City and Grass Valley. There is another over to other mines. Three other high-voltage power lines extend from that plant down there. Each carries current at 60,000 volts. They start off down river along that wide cleared right-of-way. They make a beeline over ridges and across country. Men patrol them constantly to watch the wires and to guard against forest fires. One line, 61 miles long, serves the city of Sacramento, and two others extend one hundred and forty miles clear on to Oakland and spangle all the east side of San Francisco Bay with those myriad lights you saw from afar the other night."

"Nevada has sage-brush like that on those hills over there, has it not?" interrupted Fred.

"Not," I echoed. "That sage-brush you see all over those ridges is pine trees.

"That bald spot up to the left behind your little bathhouse is the clearing they made for the stables. They lead the horses and mules up and down to and from that spot night and morning. That thing that looks like a little bungalow

The Colgate Flume

off there at the left of the bathhouse is a big boarding house for the employees. They call it a hotel.

"Do you see that straight path right up the ridge directly behind the power house? That's where the pressure pipes come down. There are five heavily riveted pipes anchored to concrete blocks. Each pipe is 30 inches in diameter, or about as high as your hip. They shoot solid streams of water down from a perpendicular elevation of 702 feet. That is more than four times the height of Niagara Falls. At the bottom each huge pipe tapers down to a four inch steel nozzle. Where the water jets out it is so dense, its force is so tremendous, that you can strike the stream with a sixteen pound sledge, and the big hammer will merely rebound as though you had struck a solid steel anvil."

"Just fancy," commented Fred.

"The nozzles point out horizontally. But they are so nicely poised on a sort of hinge arrangement that they lower or raise themselves slightly as occasion demands. Ordinarily each jet strikes an undershot blow directly into the massive steel buckets that form the outer rim of the windmill like waterwheels. There are eleven of these waterwheels, and they stand upright like the wheels of a wagon. Only they are bigger than the wheels of any conveyance. Three of them are 8½ feet high, and the thrust of water whirls them at the rate of 240 revolutions a minute. Four of them lack only an inch of being six feet high, and they whirl at 360 revolutions a minute. That means that the rims of those big wheels are going at the rate of about two hundred and twenty miles an hour.

"When, suddenly, less power is used down in the cities, the nozzles deflect automatically and partly shoot clear of the buckets.

"Inside that building there are six big electric generating machines. They are practically nothing more than large magnetic coils. Revolved rapidly, they produce electric current. Each generator is a big wheel, and on each side of it, with a common shaft running through all three, is a waterwheel. The whirl of the waterwheels, like the pedals of a bicycle, revolve the middle wheel. That middle wheel is a bundle of magnets, and from its droning and whirring revolutions come the mysterious and unseen fluid force that runs mines and factories and city street cars and elevators, and spangles the rim of San Francisco Bay at night with a galaxy of surface stars.

"As it is first produced there the electric current has a force of 2,400 volts. But it is immediately passed into ponderous cylinders called transformers. Inside them it is electrically juggled till the intensity is increased to 60,000 volts. And at that high potential it is sent into the power lines to go long distances cheaply. There are 23 transformers.

"The five main power lines that extend fan-wise from that plant form a ribwork composed of 450 miles. And there is enough big copper wire in the ramifications of the system to span the American continent with a twin line between New York and San Francisco.

Typical California Distribution Station

"Very possibly, no doubt," interrupted Fred, "but you distinctly told me, old chap,

that the electric lights were made from mountain snowflakes. Quite plainly I remember you saying just that."

"Look over there where the pressure pipes start down the slope," I continued. "Do you see the point?"

"I see no point," Fred replied. And I believed him.

"Well, any way, that's the end of the flume line. That's the flume coming along the mountain side from the right. There's a little house up there. It's one of several along the line. They are occupied by the flume tenders. The flume tenders for this plant really live higher than the superintendent."

"Oh, I see the point now," exclaimed Fred, excitedly, "right across there in a sort of obtuse angle of the trails."

"Just so," I agreed. "Well, we're going over there. Then I'll show you about this snowflake business."

At the power house a double mule team and a spring wagon were waiting on telephonic orders from Nevada City to take us to the top of the ridges. We started at once.

"They built this road to get the heavy machinery down to the plant. They didn't seem to figure on anything ever coming up," I remarked, jamming on the brake and letting the span blow for the twentieth time.

"What's the name of this blooming place?" inquired Fred. It seemed to me I detected a slight petulance in his tone.

"The Colgate power plant on the Yuba River in Yuba County, California."

By three o'clock in the afternoon we had reached an abandoned lumber camp on a ridge high above the river. We hitched the team to a tree by an old cabin.

And down we started, afoot through a beautiful forest trail, winding and steep. Suddenly we almost launched ourselves upon a cabin clinging to the cliffs. By and partly under it ran a great flume, edge full with a rushing torrent of water. We were up-river seven miles above the power house.

"Now to the dam," I exclaimed, and strode gingerly off on the plank laid on cross girders and forming a hazardous pathway almost on the surface of the surging waters of the flume. The flume is half the width of an ordinary room and so deep that men and mules used to walk through it during its construction. It carries a racing flow of 12,000 miner's inches of water, going at the speed of a Marathon runner. Nothing living can fall into it and get out alive.

A mile further up we came to the dam, a solid masonry structure built across a narrow neck in the cañon. A diverting masonry wall guided the impounded waters into concrete headgates controlling the outflow into the flume.

"This water is all melted snow from the higher mountain slopes," I began, and started forward across the crest of the dam to take the upper trail.

"Will the team be quite safe till we return?" inquired Fred, standing and mopping his scarlet features.

"Why, a man followed us on horseback to drive that team right back to the power house. We're to walk down the flume. It's eight miles."

"I don't care to see where the snow comes from. I'll take your word for it, old chap. But I'm beastly hungry."

"When they built this great flume-line," I went on, "the problem was to get enough good lumber. Ten miles back on the ridges on the other side they found a tract of big timber. They set up a sawmill, got out 11,000,000 feet of lumber, and selected more than 8,000,000 feet of the very best of the cut. All of it was required in making the flume.

"They hauled it through the mountains and shot it down from the top of the last ridge. See that Jacob's ladder climbing up out of this ravine? That's where the repair lumber still comes down a steep tramway 1,275 feet and then sweeps across to our side on a steel cable bridge swung safely above the freshet water line.

"This old cañon used to resound for

months to dynamiting blasts and the noise of many workmen building flume and power-house and dam."

"Don't you ever get tired?" came from Fred, plodding doggedly behind as we strode rapidly and silently down the flume plank, ever intent on each step. "There it goes again!" he muttered, "another of those protruding nails."

Shadows were darkening the cañon.

"I'll be jolly well glad to get to bed right after supper," came from behind me.

"Right after supper at the plant we're due to climb out of the cañon, get to our team, and drive back to Nevada City tonight," I explained.

What Fred said sounded technical and irrelevant.

Two hours later, out on the mountain road, he asked, "Are you quite sure of the way? I can't see a blooming thing, it's so beastly dark."

"Keep reaching out with your left hand," I directed, "and as long as you touch the inner bank we're safe. I don't want to rim the outer edge too close and go bumping and bounding down half a mile."

"Gracious! Whatever was that? There it goes again!" gasped Fred.

"Mountain lion screaming."

"I say, old chap, this is a most dreadful adventure you've brought me out upon."

At two o'clock the next morning we stomped into the open livery stable opposite the hotel. A sleepy man emerged from somewhere to meet us and began unhitching the weary team.

"Fine mountain lion over there," he said, jerking his head to indicate where. "Couple of fellers shot it on the way to town yesterday afternoon. Eight feet three from tip to tip."

Someone sighed audibly.

A Palace Garden Electrically Decorated

The views herewith show the garden of the regal mansion of Don Teodoro de Bary, in Buenos Aires, as it appeared when electrically decorated during an occasion when the mansion was placed at the disposal of Her Highness the Infanta Doña Isabel. The illuminations were especially brilliant, making it appear like one of the gardens of which we read in fairy tales.

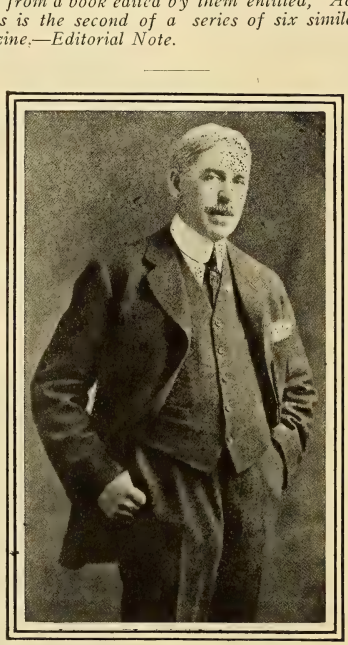
All the paths and much of the shrubbery were outlined with miniature incandescent lamps, artfully hidden among the foliage and presenting a most fascinating appearance at night.

ILLUMINATED GARDENS IN BUENOS AIRES

Advice to Freshmen

By FRANCIS C. SHENEHORN
Dean of the College of Engineering, University of Minnesota

Extracts from a lecture to the freshmen in the College of Engineering, University of Minnesota, and published through the courtesy of Waddell and Harrington, consulting engineers, from a book edited by them entitled, "Addresses to Engineering Students." This is the second of a series of six similar articles which will appear in this magazine.—Editorial Note.



Undertaking work in the College of Engineering shows courage, for only strong men knowingly enter here where the portion is man's work. No mollycoddles may hope to prosper here. You have entered a course so strenuous that success in it will call for every fiber of manliness you possess—all your pluck and endurance. You are, therefore, a body of picked men, each one of whom has the rare opportunity of completing the course and of taking up the practice of the most virile of the professions—that of engineer.

A college education is the privilege of but few men. About one man is college-bred to 800 who are not. I wish to place much stress upon the value of the chance now yours because I want you to make the most of it. You must make good, you must realize the hopes for you of those at home, you must make worth while the sacrifice made by your people for you. Do not disappoint the mother and father. Live up to what the neighbors expect of you, and graduate with honor. Do you know that out of a freshman class of men, on an average only 40 graduate while 60 drop out for one reason or another? Resolve that you are in the game to the end and that you will not quit.

Most of your schoolmates of the earlier school days are not here. The wage-earning activities of life have absorbed them. They have taken up the burden of men, but have missed your special privilege of dwelling for some years in the rare atmosphere of the academic plateau. Your special privilege is that you are becoming mentally enriched and equipped with professional training—at the expense of the state.

You must understand that while our engineers on the campus are earnest, strenuous workers for the most part, now and again men appear without the business perception to live up to their contract. For these we have a pneumatic gun into which they are gently loaded and tossed into the uttermost

realms of thin air. Do you remember the projectile which Jules Verne conceived for the trip from the earth to the moon? That had water compartments, as I recollect it, with collapsing bulkheads to absorb the starting shock. Well, our projectile has no collapsing bulkheads.

Now, I am going to give you a term to express the kind of men we desire as a product of this college. We want "thorough-breds" and I wish to tell you what a thorough-bred is as I mean it. Perhaps I can do this most quickly by telling a story. Governor Odell of New York related it. He said he was out hunting with his father one day, and they had with them an Irish setter which was a thorough-bred, and they had also a yellow dog. His father picked up the yellow dog by the nape of the neck and held it out at arm's length and the yellow dog whined piteously. He dropped it and picked up the Irish setter. The setter hung there with never a whimper. He said, "My son, that is the difference between a thorough-bred and a yellow cur." Now, what the thorough-bred had was self-control. It certainly hurt him just as much as it did the yellow cur, but he did not whimper; and self-control is the one thing that will let a man win out in life.

Now there are certain things in your college course which I wish to bring into high prominence. An engineer in his direction of the forces of nature is an expert mathematician, applying to useful ends his mathematical attainments. The backbone of the engineer is mathematics; and you men, if you are going to succeed in your college course, must get a firm grip on your mathematics, and clear up everything as you go along. To get behind in mathematics is fatal. Other courses depend on it. Your physics of the sophomore year and your mechanics which comes later require higher mathematics as a pre-requisite. If you have failed to pass or are conditioned in your mathematics, you are at a serious disadvantage; and I advise you in the strongest terms to get your mathematics right. You are building a pyramid, and in the first course of masonry lies your freshman mathematics. You cannot lay your second course of masonry until the first course is completed.

Because our profession has so recently emerged from the trades, our culture is questioned. Many people do not distinguish between a locomotive engineer and a mechanical engineer. If you are satisfied with the wages of a trade, you will not need to speak and write clearly and effectively, you do not need to study English and German or French—but you cannot graduate at Minnesota! This is not a trade school, but a professional school. You will need to do just as conscientious work in rhetoric or language as in your technical studies. We want Minnesota engineers to reach the high ranks of the profession, and not pass through life as subordinates. You will be useful men as subordinates, but there is something more useful and better. You find it hard to believe that language studies will help you as engineers, but take this on faith now and make your scholarship excellent in them. That these will count, accept as expert judgment.

First of all, keep yourself in good physical trim. You must have enough to eat. You must eat wholesome things. You cannot expect such an engine as you are to do work without the proper fuel. Then you must get the proper sleep. Do not let any fairy tales about Napoleon's capacity for work on six hours' sleep lead you to burn too much midnight oil, because the more accurate historical fact is that Napoleon needed eight hours' sleep the same as the rest of us men. You need some exercise and that has been provided for the most part, in your drill; but you ought to get out and breathe the open air some minutes or an hour daily; and you ought to absorb the sunshine into your blood and get the wind into your pulses, in order to keep yourself in the best possible condition.

If, however, you overdo this matter of physical exercise, you use up the energy which you need for proper study. Therefore, the rule for exercise is "Not in excess, just in moderation."

I am not going to say much to you young men about drinking, because I am certain it is not necessary. We business men look upon a man who drinks as a fool, as a yellow cur. The "whiskey breath" warrants discharge from a man's position in many corporations in this country and it discredits a man.

Smoking in moderation is not very bad, but for you it is not now worth while. The disadvantages are real, the advantages in good fellowship and relaxation are intangible. A man may be splendidly virile, and yet not smoke. Mollycoddles smoke cigarettes, but some strong men also smoke them. Smoking is really in the "twilight zone," between good and bad. The clear daylight is better for young men.

You must assure yourself of reasonable quiet and freedom from interruption, if you would study effectively. Form the habit of absolute attention to the task in hand. Keep parallel all the forces of your mind in the direction toward which your work tends. Be master of your study hours, and do not permit any one to interrupt you. In "Tom Brown at Oxford" I remember they had a special oak door to close when a man was at study and not to be interrupted. He was said to be "sporting the oak" and it was bad form to interrupt him then. When you have work to be done, do not hesitate so to inform your caller. Be courteous, but do not permit your study hours to be encroached upon. Be systematic. Keep your room, your books, and your papers in business-like order. Disorder in your environment will put disorder in your brain, and into your work.

I want to speak in closing of the profession of engineer. It is such a splendid profession. Its horizon is so wide. It is so modern as to be full of the spirit of youth, and yet it is as old as the pyramids. It is vibrating with new life, new applications of old laws. It is so helpful. It builds, and old earth becomes a better place. It gives to the poor ways of travel that the rich of old knew not of. It takes the brutal part away from human labor, and floods the night with light. It is creative. The engineer is a partner of the gods and the master of gravitation.

Specifications for a Good Engineer

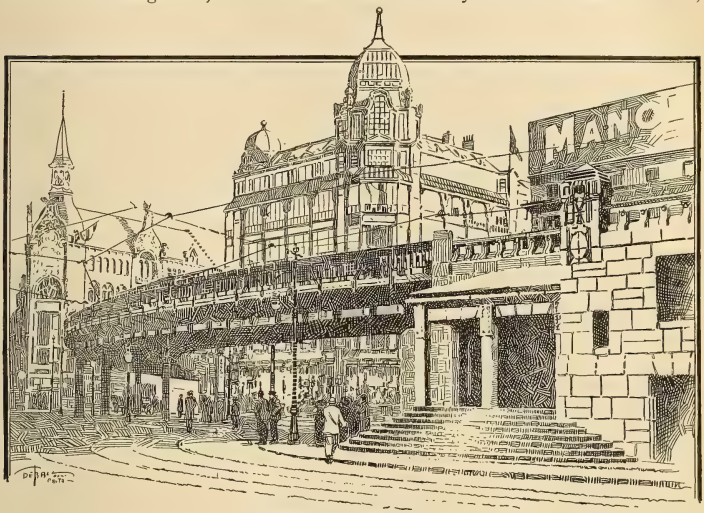
"A good engineer must be of inflexible integrity, sober, truthful, accurate, resolute, discreet, of cool and sound judgment, must have command of his temper, must have courage to resist and repel attempts of intimidation, a firmness that is proof against solicitation, flattery or improper bias of any kind, must take an interest in his work, must be energetic, quick to decide, prompt to act, must be fair and impartial as a judge on the bench, must have experience in his work and dealing with men, which implies some maturity of years, must have business habits and knowledge of accounts. Men who combine these qualities are not to be picked up every day. Still, they can be found. But they are greatly in demand, and when found they are worth their price; rather, they are beyond price and their value cannot be estimated by dollars."—*Chief Engineer Sterling's Report to the Mississippi Levee Commissioners.*

Hunts Diamond With Flashlight

A St. Louis young lady while walking through one of the parks discovered that she had lost two valuable diamond rings. She returned over the gravel walks that she had traversed and found one of the rings, but failed to find the second one. She procured an electric flashlight and waited until dark when she again resumed her search. The glint of the gem under the flashlight ray soon attracted her attention, and she reported to the police, who had been notified of her loss.

Hamburg's New Railway

While in America the elevated railway system is usually preferred and in Great Britain the underground, in the German empire they use a combination of both. Thus Berlin is the possessor of such a line which starts as an elevated in the east, goes down in the center beneath the pavement, rises up again and ends in the western suburb, Charlottenburg, as an underground railway. Now Berlin has a competitor, as very recently in the second largest city, the famous port of Hamburg, such a combination line has been opened.

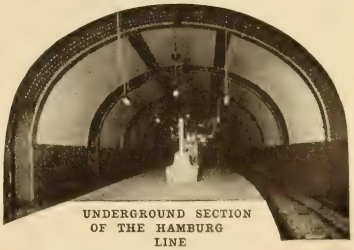


HAMBURG ELEVATED RAILWAY

The new Hamburg line is fifteen miles long, one-fourth of the whole running under the pavements. The old city is cut up by many canals, rivers and ponds, and, besides, is very hilly, therefore the line contains several miles of stone viaducts, no less than fifteen bridges and some 43 street crossings at two levels, all built at great cost.

The cars are fitted with two motors, each of 100 horsepower, an arm touching the third rail from beneath so that the latter is insulated above. Thus you may walk upon it without danger. A new block system of Siemens & Halske, of a type which has never been tried before, has been introduced. It works so perfectly that human activity is almost excluded.

As the trains operate under varying conditions, now in daylight and the next moment in tunnels, the lamps in the cars are automatically lit and extinguished when approaching and leaving a tunnel.



UNDERGROUND SECTION OF THE HAMBURG LINE

Electrical Securities

By "CONTANGO"

Something About the Price of Stocks and Bonds and Their Market Fluctuations—the Commission of Brokers and Bankers When You Buy or Sell Through Them—Explanations of Various Financial Terms and Details Given to You in Plain English

You, the investor or seeker after information concerning electrical enterprises, have already been advised in previous issues of this magazine as to the general characteristics of reputable brokers and bond houses, and by what means you can best judge their standing. In the last article great stress was placed on the time to buy and a promise of further financial details was given.

All the big and established houses have much the same rules, or customs, in their relations with their customers. Thus for example, a bond house will execute an order for a small number of bonds without charge or expense to you, so that the handling of your transactions may be retained. It will doubtless also interest you to know that when you want to sell some of your securities, supposing them to be of one of the older and well established electrical concerns, there will be a charge of something like ⅛ of one per cent or even as low as 1/16 of one per cent. For example, say one bond sells in the market at 103. Then in selling them through your broker you will be charged the small discount of ⅛ to 1/10 of one per cent, which the broker takes for making the transaction. Any good bond has a ready market. They are—bearing in mind among others the bonds of the large and well known electrical generating enterprises—just as good as cash and in a degree better because you are not so likely to spend them, i. e., realize on them once possessed, until maturity compels.

You must also understand that you can often deal direct with the company issuing them and save all charges. Of course, if the bonds have been underwritten, that is, purchased in block by some firm of bond dealers or bankers with a view to selling them out to the public as individuals, or to large corporations which invest in such securities, there will be to the purchasers the difference in the price at which the bonds in quantity were delivered to the brokers or bankers and the price set in the open market. This is the profit to the underwriters or original purchasers, but they take all the risk of floating the securities, that is selling them to the public.

You must understand clearly that the final price both for bonds and shares of stock is regulated by the public demand and confidence in them. There are many things that create demand, and it has been the purpose in these earlier articles to lead up step by step to the reasons why the public should make their demand felt. It is the confidence derived from the past record of the company, the present management and the future prospects.

This brings us to the consideration of the terms of maturity for various bonds and its connection with the price at which they sell. Some bonds are issued to the public for a short period—say ten years—others run for 30 years: the periods vary. Now the long time bond selling at a premium or above par naturally, everything else being even, has the high price over the short term bonds, for they are all issued in par denominations of $100, $500 or $1,000, as the case may be, and in proportion as they draw near maturity or the end of their term, so does the premium dwindle until in the last year they are worth for cashing-in purposes just what their face value represents, that is to say, the $100, the $500, or the $1,000, as the case may be. In the early stages when they had long periods to run they might have been quoted as high as 110.

This is a point not easily grasped at first and may be elaborated upon as fol-

lows: Suppose a company issues a $1,000 bond which matures in ten years. It is so desirable that it is worth above par, say 105. You would then pay $1,050 for the bond. The $50 premium which you pay, distributed over 10 years represents $5 a year, which you are willing to pay because of the soundness of the bond. Now suppose the same company issues another bond exactly as well secured and just as desirable, but maturing in 20 years. If the price of the 20-year bond were 105, the $50 premium you would have to pay would, when distributed over 20 years, represent only $2.50 a year, and everyone would wish to buy the 20-year bond. Therefore, to place the 20-year bond on the same market basis its price would naturally be 110. And, to put it in another way, if you buy your bond of $100 denomination at say $95 then the sooner it comes to the maturity the better for you and, therefore, the shorter its life the better in a general sense.

The price, of course, affects the yield, and it is, after all, the yield with perfect security that most interests you when looking for investment. Thus you can readily see that if you are buying high priced bonds paying five per cent nominally, that is at par, the yield to you lessens in proportion to the price you have to pay and this may bring your five per cent bond down to an annual yield to you on your investment of only 4½ per cent. It is the same if you purchased stock, for you buy at the market price, unless, as before pointed out, being a shareholder and a new issue of shares being made, you have the privilege of subscription at par.

But again understand clearly that the price for shares of stock is just like that for merchandise, and, there being no false play or manipulation, is regulated entirely by the law of supply and demand. Thus when all stocks are in a booming condition owing to the favorable business conditions, either general, or in the case of individual shares because of specific facts affecting that particular company's business, then the shares fluctuate in price up and down, following the trend of the market. Those most stable move the least except there be special causes relating to them.

For example, the demand for electrical equipment the past year or two, and this year so far, arising from the development of great central station systems, has created considerable of an upward movement in the shares of the great producing and operating companies, such as the General Electric Company, which has been doing an excellent business with orders ahead of the same period last year. These are special conditions affecting that particular industry.

Now a word or two as to some of the more generally used financial terms:

Investments: this represents the money you put in the stock or shares of companies by way of becoming part owner, or which you lend to a company as a bondholder, mortgage bondholder, or holder of debentures.

Securities: the term used very generally, but not accurately, to describe the financial offerings of any particular company. But in truth the term "securities" really relates only to bonds of the various kinds. The best way to describe a security is—any bond or preferential stock guaranteeing to its holders a *fixed return of interest* on money lent, or if you so wish to say, invested. An investment in ordinary shares or stocks, the dividends on which fluctuate, does not come within the meaning of the word securities. Moreover, securities implies something with a guaranty behind it, as in the case of an ordinary bond with either a trust deed or mortgage to cover and protect it.

Bonds: this name covers several forms of security. The ordinary bond represents money lent and the return of which is payable to bearer with the interest specified and guaranteed. But once registered the bonds cannot be delivered from hand to hand. Bonds may or may not

bear interest bearing coupons corresponding to the number of interest periods during the life of the bond. The larger issues are for the convenience of those who desire to invest in big amounts and thus do away with the multitude of coupons. Bonds are made payable as to principal within certain periods, and *maturity* is the time when they come to an end and have to be cashed in or exchanged for other bonds or securities.

Income Bonds: these are not exactly bonds, as they have no trustee deed or mortgage rights behind them, but are in reality a form of preference shares.

Mortgage Bonds: these represent the direct result of a company executing a trust deed by which it specifically mortgages its property to cover loans obtained from public subscription. It is very essential if there is the slightest doubt as to the *standing* of the company floating bonds, that the terms of the trust deed be thoroughly examined and understood.

Stock, or Shares of Stock, as it is sometimes expressed: by the general term stock is meant the capital of the company in which ownership rests. Stock may be acquired in any amounts, no matter how small, according to the specified value of each share of stock. But shares in their exact sense represent specified amounts of stock. That is the difference between the two terms, but in a general way they represent one and the same thing. It is the capital of the company and means ownership. Stock takes all the profits and losses. Bonds remain with their fixed rate of interest no matter how successful the company may be.

Dividends: these are the profits available for distribution among the owners of the capital stock of the company—the shares of stock—after all working expenses, bond and debenture interest and the like have been paid.

Fixed Charges: represent the interest to be paid before dividends can be paid.

Cumulative Dividends: is the term applied to any fixed rate of dividend on shares or stock and which becomes a debt on any company's future earnings if at any time the original and fixed amount has been unpaid wholly, or in part, over any date when it would be due.

Interest: this is the money paid on loans obtained through the sale of bonds. It is quite distinct from dividends and is paid on bonds, mortgages and the like. Interest is paid on debentures.

Debentures: are really certificates or acknowledgments of indebtedness—but a debenture is not a mortgage and, therefore, always very careful information should be obtained as to the security behind it, as it really is no more than a company's acceptance of an obligation to pay a certain sum.

Assets: this represents the property a company possesses, i. e., its lands, real estate, buildings, stock in trade, investments in marketable securities, money owing, cash on hand and the like. The physical assets are the actual property holdings with the buildings and machinery thereon, including conveyances and transportation facilities, coal and other such property.

Certificate: is the paper which testifies as to the ownership in a joint stock company.

Yield: this represents the rate the company returns on every $100 of the capital stock or on every part of a $100. It is the rate per cent after the existing price of the stock or bonds is considered.

Commission: is the fee charged by brokers on transactions involving the purchase or sale of stock or bonds.

Bear: is the name given one who sells shares for a fall in prices.

Bull: is one who buys shares for an advance in prices.

And finally the term "Contango" is an expression in use on the London Stock Exchange in particular, to designate the interest or charge exacted for the continuance of a transaction from one settlement day to another. It is a technical term used among brokers and might be likened to the continuance fee paid for continuing a case in a court of law.

Whisper Girl for Theaters

Charles Frohman, the American theatrical magnate, has introduced an innovation at his Globe Theater in London which has proven highly pleasing to patrons. A telephone operator back of the scenes takes any messages over the telephone from outside for any member of the audience or members of the company. In the former case the messages are retransmitted over a delicate "whisper phone" which is connected so that every seat in the lower part of the house can be reached. The girl is called a "whisper girl" because of the delicate transmitter she uses and from the fact that she must whisper her messages in order not to disturb the performance. The members of the company are whispered to through phones connecting with the dressing rooms. The first message the "whisper girl" received was from a man to his wife in the dress circle, stating that he was going to return home late.

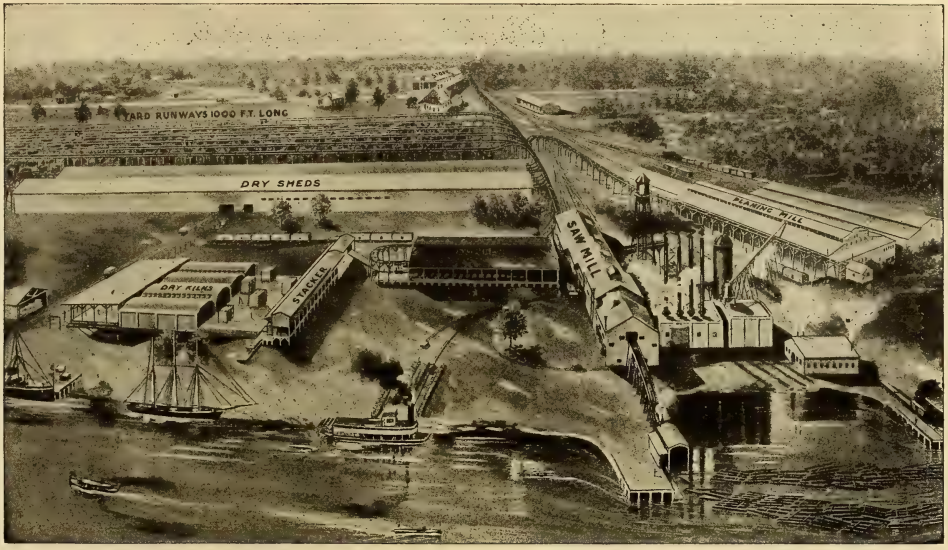
Copyright by the Illustration Bureau, London

THE WHISPER GIRL OPERATOR

New Electric Welding Process

A new electric welding process which joins iron and steel quickly, safely, and with a minimum expenditure, is the result of a recent patent by a German engineer. The new process allows all of the molten welding metal to be deposited at the exact spot desired. To accomplish this the force of magnetism is used to attract the welding metal in a molten condition and flow it over the surface to be welded. It makes no difference whether the weld is being made over a workman's head or not, the melted welding fluid, which is heated by the electric current, will be attracted to the desired point and follow the lines of magnetic attraction, flattening itself out at the point of the weld.

In the process, the electric arc used is drawn between the metal to be welded and a metal electrode. This is done by using a welding clamp on the article to be welded, which is held in place by a few coils of wire around it, which magnetize it and make it stick fast to the material on which the weld is to be made. This magnetizes not only the clamp but also the welding wire which forms the metal electrode and is melted by the heat generated. As this melted metal drops from the welding wire it follows the lines of force and flows over the metal at the point to be welded. Thus the magnetism resulting from the turns of wire around the welding clamp serves a double purpose; that is, it is used to deposit the melted metal where it is needed, as well as keep the clamp firmly fixed to the article being welded.



This is a picture of the cypress mill of the F. B. Williams Company, Patterson, La., where traveling monorail electric hoists, described in the June issue, are used almost entirely to handle the lumber. The planing mill, dry shed, storage yards, sorter and loading platforms are all connected by the monorail system, totalling 5½ miles of track.

Train Struck by Lightning

So seldom are reports received of a railway train being struck by lightning that many persons suppose that special protection is afforded by the abundant metallic connection of the train with the soil through which the electricity is led away. However this may be, a fast train was some time ago struck by lightning during a violent storm in France, between Dijon and Lyons. The last car of the train was the one hit. A part of the ceiling of the corridor was smashed and the pieces fell to the floor. There was no fire and no one was hurt, and after a stop to take account of damages the train pursued its way.

A Test for Radium

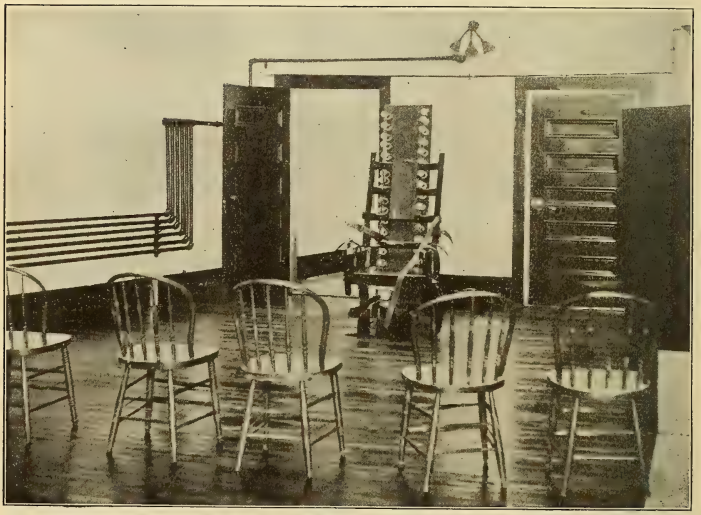
All clear-yellow or greenish-yellow dirt may turn out to be a variety of earth that contains radium or radio-active minerals. A test for radio-active substances may be made as follows: A photographic plate is placed sensitive side up in a box which is made impervious to light. The ore or mineral is then placed on top of the box for a week or ten days. At the end of this time the plate should be carefully developed. If diverging rays of fog, shadows and black spots are found on the plate radio-activity may be assumed to be present. It is always advisable to make more than one test to be certain.—L. K. Hirshberg.

ENGLISH ROYALTY AT THE ALDERSHOT EXPERIMENTS

The King and Queen of England are watching recent experiments at Aldershot in connection with the use of portable wireless outfits on aeroplanes. Behind them is seen the motor car generator which supplies power for the sending equipment. The queen is looking intently at the aviator, who somewhere up in the sky is receiving the message. His Majesty takes a deep and practical interest in airmanship and all that pertains to it.

Execution by Electricity

Humane as is the electric chair for executions, compared with the old-fashioned scaffold and hangman's noose, or the bloody guillotine, still used in France, this method of executing a condemned person is not without its horrors, and experts in Boston have suggested improvements to do away with some of these. Much of the horror of it could be eliminated and the execution shortened by the placing of the electrodes on the back of the head and over the heart, instead of on the top of the head and on the left leg, as is now done, and as was done in the recent electrocution of Rev. Clarence V. T. Richeson, the murderer, at the Charlestown (Mass.) State Prison.



Copyright by the Boston Photo News Co.

THE ELECTRIC CHAIR IN THE CHARLESTOWN STATE PRISON

The current of electricity causes death by paralyzing the heart. Therefore, it is merely necessary to send the current through the heart. By placing the electrodes as above described, it would be possible to use a much lower voltage than the 1,900 volts now used. The burning of the hair and flesh on the skull, caused by the resistance to the current of the bony structure of the head, and other disagreeable phenomena, would be eliminated. Death would be practically instantaneous. Bone is a non-conductor of electricity, and in the case of a thick skulled person there must be a tremendous resistance to the current from the electrode on the top of the head.

An execution by electricity in the state of Massachusetts costs $348.58. The electrician who throws the switch is paid $250; the balance goes for salary of guards, warden, chaplain, medical examiner and burial. The executioner is supposed to be unknown, and is hidden from the legal witnesses and from the prisoner's view before the black mask is adjusted by a screen. He has, however, a full view of the prisoner, and of the warden, who signals for throwing the

switch. He may wear a mask to hide his features, if necessary.

The electric chair is a solidly made wooden apparatus, with heavy leather straps for the arms, chest and legs of the prisoner. At one side is the electrode which is attached to the left leg. A head rest holds the prisoner's head firmly in position and the other electrode is strapped down to the top of his head, where a space several inches wide has previously been shaved. A black rubber mask is adjusted over the face, with eye-holes and holes for the nose and mouth.

The warden, who has personal charge of all executions, watches the rise and fall of the prisoner's breath and gives a signal to the electrician just when the exhalation comes. It is necessary for him to bend over the man in the chair to watch closely. While the warden's hand remains raised, the electrician keeps on a current of 1,900 volts. As the warden lowers his hand, the voltage is gradually decreased. This is twice repeated, the electrician leaving the current on fifteen seconds the third time. Back of the electric chair is a board with a double row of incandescent lights, which may be connected with the electrodes to test out the connections.

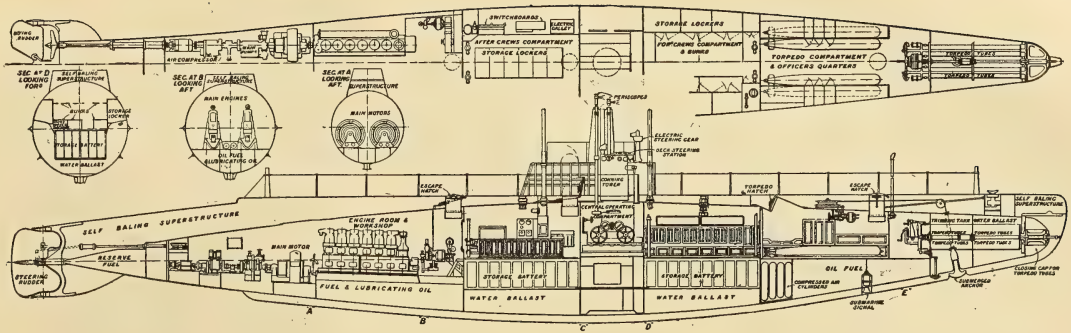
An Electric Waffle Wagon

An enterprising young Chicago man has applied electricity to his business, that of vending waffles and ice cream about the city, by having a body built upon the frame of an electric automobile. The body is painted white and is fitted with doors and windows of artistic design. Within, there is ample room for a small refrigerator and cooking apparatus, and underneath the body is a compartment for the batteries. The vehicle is driven an average of 75 miles a day and impresses one with its cleanliness, which in turn creates a desire to eat some of the products.

ELECTRIC WAFFLE WAGON

Radium in the Air

If it were not for the assurance of the almost immeasurably small quantities one might feel alarmed at the disclosure of radio-active material in the atmosphere. It was first collected by Elster and Geitel on a negatively charged wire some years ago, and was shown to consist of the active emanations both of radium and thorium. The experiments have been now repeated by Kinoshita, Nishikawa, and Ono in Tokyo with improved apparatus, and the net result of their labors is to show that either the first investigators exaggerated the amount of radio-active material present, or else that there is much less radium emanation in the air of Tokyo than in that of Chicago, Montreal, or Cambridge. The amount of the emanation is, in any case, not large enough to cause apprehension, for it is measurable only in billionths of a "curie," the unit so named after the discoverers of radium. But though the quantities are so minute that a mathematical mind is required to appreciate them, it is demonstrable that there is several thousand times as much radium in the air as thorium.



THE DETAILS OF A WHITEHEAD SUBMARINE

A partial plan view and a longitudinal section of a modern submersible torpedo boat of the Whitehead type is shown in the above drawing. It was built for the Dutch navy and modified forms of this boat are largely used by the United States and English navies.

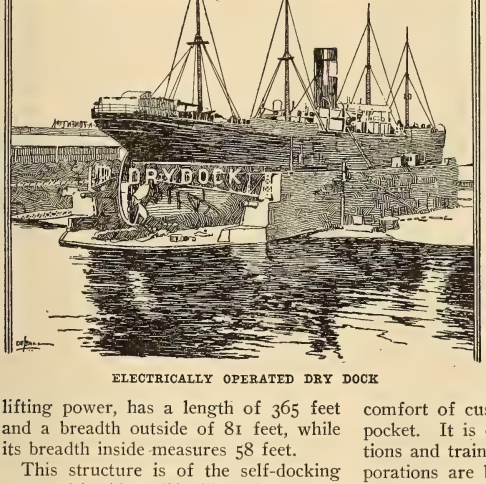
This boat is able to make a surface speed of eleven knots per hour, and at a speed of ten knots has a radius of action of 500 miles. While navigating on the surface it is propelled by a 300 horsepower Diesel engine. When it dives beneath the waves, however, the power is supplied by a storage battery, through a 300 horsepower electric motor. Submerged, a speed of seven knots per hour for five hours is obtainable. That is, it can pass from sight and not come up until it is some 40 land miles away.

In the 200 ton boats of this type there are fixed berths for twelve men. At the bow are to be seen the torpedo tubes, from which the torpedoes, with their terrific charges of guncotton, are propelled. Just over the engine room is to be seen the escape hatch through which the men can come to the surface in case of emergency.

On the occasion of its trial tests one of these boats went down 97 feet without showing any signs of deflection.

Electrically Operated Floating Dry Dock

The accompanying illustration shows an interesting Dutch floating dock, electrically equipped. It is of 4,500 tons



ELECTRICALLY OPERATED DRY DOCK

lifting power, has a length of 365 feet and a breadth outside of 81 feet, while its breadth inside measures 58 feet.

This structure is of the self-docking type and is able to lift ships with a draft of maximum 20 feet. It is provided with three centrifugal pumps, each pump being driven by an electric motor supplied with current at 100 volts. These pumps are able to raise, within three hours, vessels of 8,000 register tons, which means about 4,000 tons displacement.

Good Light as an Asset

Measuring results in dollars and cents, scientific illumination is a valuable asset. It appears on the ledger as maximum office efficiency, with minimum office force; maximum factory output, with minimum of "rejects" and "seconds"; maximum satisfaction of customers, consumers, clients—every one to whom you furnish goods or service—with minimum of complaint and trouble; maximum of health and comfort for yourself, your employees, your customers, with minimum of worry, annoyance, and expense; maximum of light to use, with minimum of current to pay for.

The value of good illumination is not realized because it is so subtle. People feel it unconsciously. They avoid a store that is harshly or inadequately illuminated. They avoid harsh lighting just as they avoid noise. On the other hand, in a store where the illumination is quiet but effective they stay longer, do their shopping better and buy more without knowing why. They speak well of the store and visit it often.

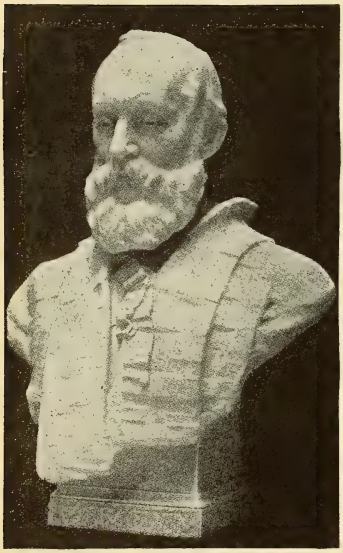
The same thing applies to restaurants and other places where the comfort of customers is money in your pocket. It is even true of railroad stations and trains; for public service corporations are becoming more and more alive to the money value of making their customers comfortable.

The cash value of good illumination in efficiency of employees cannot be overestimated. They work better and with less strain when they have just the kind of light and quantity of light suited to their work. Their eyes are better, their health is better, their heads are clearer. They don't get sick so often and stay away. The output is better, and there is certain to be more of it.—*Scientific Illumination.*

When a battery is only partially discharged it requires only a partial charge. Charging a battery that is already full is not only a waste of current, but is injurious to the battery, and care should be taken to cut off the current just as soon as the maximum charge is attained.

Presentation of Bust of Lord Kelvin

On May 16 a marble bust of Lord Kelvin was formally presented to the Institution of Electrical Engineers, Lon-



BUST OF LORD KELVIN PRESENTED TO THE INSTITUTION OF ELECTRICAL ENGINEERS

don, in accordance with the desire of Lady Kelvin. In behalf of Lady Kelvin the memorial was tendered to the Institution by Sir W. H. Preece, who was followed by Prof. S. P. Thompson upon the achievements of the great scientist. Mr. Ferranti accepted the bust on behalf of the Institution.

American Lamps Superior

Not so long ago Sir William Preece made some statements before the British Association which are calculated to disturb the equanimity of English manufacturers of electric lamps, especially since he based them upon tests made at the instance of the Engineering Standards Committee. He showed, among other things, that the British made lamp falls short of the American made lamp in efficiency, in life and in accuracy of rating. Many English lamps nominally of sixteen candlepower, purchased in open market, showed an average of only 13.2 candlepower, as against 16.2 for the American lamps. They showed also a much smaller efficiency, and their useful life was only one-fifth that of the American article.

Dr. Bell Reminisces After 35 Years

Thirty-five years ago the 25th day of last June Dr. Alexander Graham Bell placed on exhibition for the first time his telephone at the Philadelphia Centennial. At that time (1876) Dr. Bell was teaching in a school for the deaf in Boston and disliked very much to leave his work. In an address which has just been published, delivered Nov. 2, 1911, in Boston before the first meeting of the Telephone Pioneers of America, he told of these early experiences.

"So I went down to Philadelphia," said he, "growling all the time at this interruption to my professional work, and I appeared in Philadelphia on Sunday, the 25th. I was there, and trotted around after the judges at the exhibition while they examined this exhibit and that exhibit. My exhibit came last. Before they got to that it was announced that the judges were too tired to make any further examination that day and that the exhibit could be examined another day. That meant that the telephone would not be seen, for I was not going to come back on another day. I was going right back to Boston.

"And that was the way the matter stood, when suddenly there was one man among the judges who happened to remember me by sight. That was no less a person than His Majesty Dom Pedro, the Emperor of Brazil. I had shown him what we had been doing in teaching speech to the deaf in Boston, had taken

him around to the city school for the deaf and shown him the means of teaching speech, and when he saw me there he remembered me and came over and shook hands and said: 'Mr. Bell, how are the deaf mutes of Boston?' I said they were very well and told him that the next exhibit on the programme was my exhibit. 'Come along,' he said, and he took my arm and walked off with me,—and, of course, where an emperor led the way the other judges followed. And the telephone exhibit was saved.

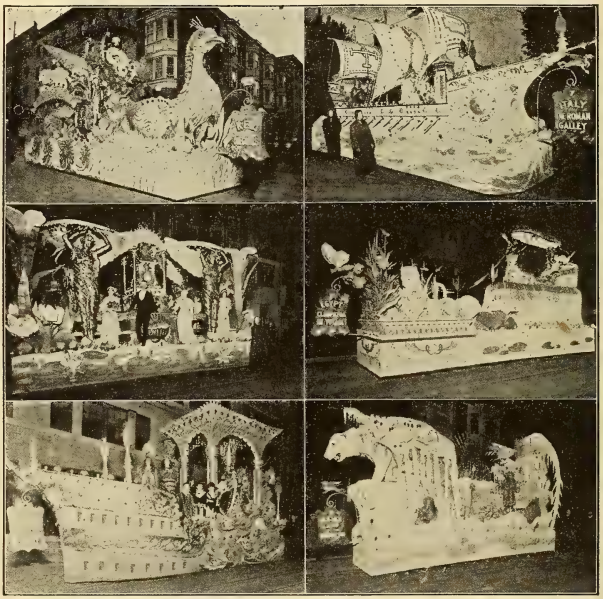
"Well, I cannot tell very much about that exhibit, although it was the pivotal point on which the whole telephone turned in those days. If I had not had that exhibition there, it is very doubtful what the condition of the telephone would be today. But the Emperor of Brazil was the first one to bring that situation about at that time. I went off to my transmitting instrument in another part of the building, and a little iron box receiver—you probably all know what it was from diagram—was placed at the ear of the emperor. I told him to hold it to his ear, and then I heard afterwards what happened. I was not present at that end of the line. I went to the other end and was reciting: 'To be or not to be, that is the question,' and so on, keeping up a continuous talk. I heard afterwards from my friend, Mr. William Hubbard, that the emperor held it up in a very indifferent way to his ear, and then suddenly started and said: 'My God! it speaks!' And he put it down; and then Sir William Thomson took it up and one after another in the crowd took it up and listened. I was in another part of the building shouting away to the membrane telephone that was the transmitter. Suddenly I heard a noise of people stamping along very heavily, approaching, and there was Dom Pedro, rushing along at a very un-emperor-like gait, followed by Sir William Thomson and a number of others, to see what I was doing at the other end. They were very much interested. But I had to go back to Boston and couldn't wait any longer. I went that very night.

"Now it so happened there, that although the judges had heard speech emitted by the steel disk armature of this receiving instrument, they were not quite convinced that it was electrically produced. Some one had whispered a suspicion that it was simply the case of the thread telegraph, the lovers' telegraph, as it was known in those days, and that the sound had been mechanically transmitted along the line from one instrument to the other. Of course, I did not know about it at that time; but when the judges asked permission to remove the apparatus from that location, I said: 'Certainly, do anything you like with it.' But I could not remain to look after it; they had to look after it themselves. My friend, Mr. William Hubbard, who had kindly come up from Boston to help me on this celebrated Sunday, the 25th of June, said he would do his best to help them out, although he was not an electrician. He knew nothing whatever about the apparatus, beyond being in my laboratory occasionally, knowing me well. But he undertook to remove the apparatus and set up the wire under the direction of the judges themselves. So they had an opportunity finally of satisfying themselves that speech had really been electrically reproduced."

Fortuny Stage Lighting

The system of stage lighting devised by Meriano Fortuny, of Venice, whereby a diffused light, very like daylight, is obtained, is most ingenious.

Fortuny uses electric arc lamps, so arranging them as to secure a reflection of their light from surfaces of cloth. The cloth for the purpose is made in broad strips, alternately light and dark, so that a dead white glare is avoided. The proportions of light and dark vary, and the cloth is arranged on rollers, controlled from in front of the stage, so that the operator can watch and change effects at will during the progress of the play. The sky backing for each scene set is arched, to further the illusion.



PORTLAND ROSE FESTIVAL

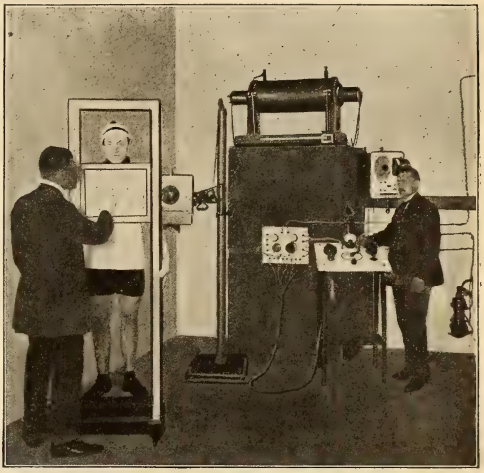
The dramatic unmasking of Rex Oregonus on the night of June 15th terminated another of Portland's famous Rose Festivals. By far the most notable feature of the evening was the electrical parade which followed a route over 5½ miles long through the heart of the city. Above are some pictures of a few of the most elaborate floats all of which were mounted on electric flat cars deriving current for their propulsion, and for lighting the thousands of lamps, from the overhead trolley. It is estimated that fully 250,000 persons viewed the pageant and all of them voted it "the best one yet."

The floats were made to represent the various countries, and also historical incidents. These were the imperial family of Russia, home life in Holland, Japan the land of cherry blossoms, a Roman galley, Alaska, Columbus' triumphal return, the Land of the Midnight Sun, the Durbar of India, and a score of others. These were all so brilliantly lighted that, as they passed along, the regular street lighting appeared to pale in comparison.

X-Ray in Studying Athletes

The most divergent views have so far been prevalent among medical men with regard to the effect of athletic exercises on the human organism, especially on the heart. Whereas some practitioners believe the action beneficial, others were of opinion that any continued exertion is liable to produce fatal injury, especially dilatation of the heart.

The continued strain on the sportsman's attention may result in a certain nervousness, but any fear of organic injury seems to be practically unfounded. In fact, the use of X-rays has allowed the behavior of the heart to be watched at frequent intervals during exercises, permitting observing any possible alteration. The recent six-day cycling races held at the Berlin Sporting Palace afforded an excellent opportunity of putting this method to a practical test.



STUDYING AN ATHLETE WITH THE X-RAY

While the cyclists on the wooden 66 meter race course hurried along at a lightning speed, scientific men far down in the basement of the building were busy at work investigating a problem which had long been disputed. An X-ray apparatus of special construction allowed an X-ray record to be obtained within one one-hundredth of a second. This, in connection with a new process designed by Drs. Strauss and Vogt, enabled the shape of the heart to be reproduced on the screen and to be recorded with its accurate dimensions within ten to twelve seconds.

In view of the interesting and valuable results to be expected from these experiments, all the competitors in the races willingly agreed to betake themselves after each individual performance to the X-ray laboratory in order there to have their hearts measured.

While details of the results obtained in this connection have not yet been made known, this much can be said, that the apprehensions entertained by many prominent physicians as to the weakening effects of sport on the human heart are at least exaggerated.

The Electric Swan Boat

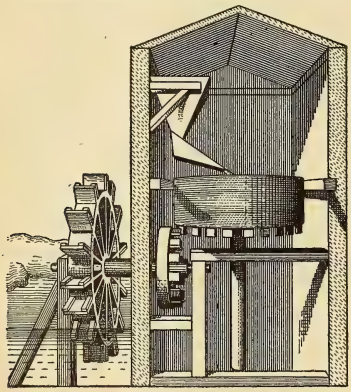
The electric swan boat, in which passengers and driver ride, has rigidly connected with it, at the bow end, a swan shaped tug containing an electric motor driving a propeller. The craft is steered by means of reins attached to the head of the swan, which turn a rudder of ordinary pattern. The driver has also close at hand a regulator, which gives him control over the machinery in the swan. The vibration of the boat is said to be much less than in one that carries its own motor.

From Ancient to Modern Water Wheels

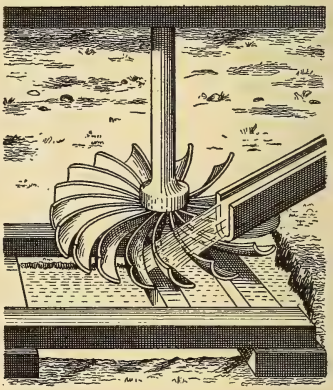
The Chinese claim the use of water wheels as far back as 1000 B. C., but at that time human labor was too cheap and human wants too simple to require any extensive use of the energy from flowing water.

The American Indian and the early settlers in the New World ground corn by placing it on a hollowed rock and then crushing it with a second stone by using muscular labor, yet back as far as 14 B. C. in Rome a crude wheel served to operate the mill stones for the grinding of corn. This form of wheel was operated by the current flow of the stream.

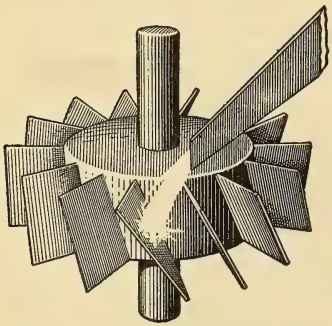
At an early but unknown time an advance over the current wheel was made by placing blades upon a vertical shaft and in such a position as to receive the energy of the water by having it strike the blades, and this type, a form of "impact wheel," forecast the modern steam turbine.



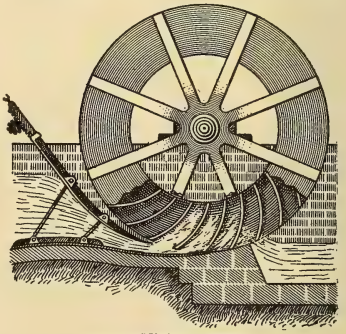
GRINDING CORN WITH A CURRENT WHEEL—ROME 14 B. C.



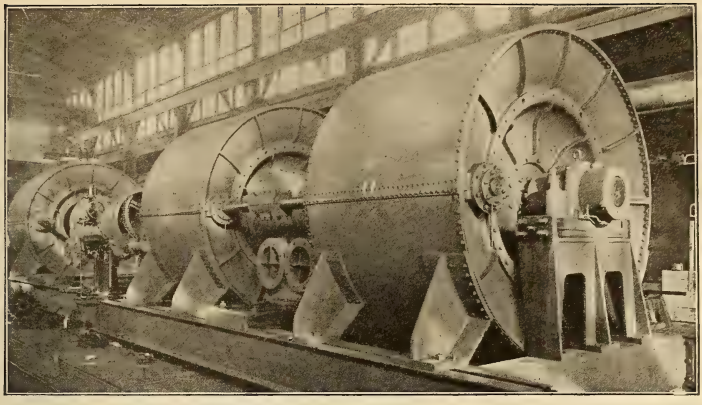
THE IMPULSE WHEEL



THE IMPACT WHEEL



THE UNDERSHOT WHEEL



A MODERN HYDRAULIC TURBINE GENERATING ELECTRICITY IN THE PLANT OF THE MADISON RIVER POWER COMPANY, MONTANA

Some 130 years ago a Swiss mathematician, Euler, began considering a curved blade to receive the water and the "impulse wheel" with spoon-shaped buckets was the result. The overshot wheel which operated from the weight of the water carried from the top of the wheel down the far side proved cumbersome and often costly, as regards the masonry work to get the water to the wheel. The undershot wheel was a decided advance in that the water was received on curved surfaces upon the underside of the wheel in such a way as to make its velocity count and the increase in efficiency over more ancient wheels was around 50 per cent.

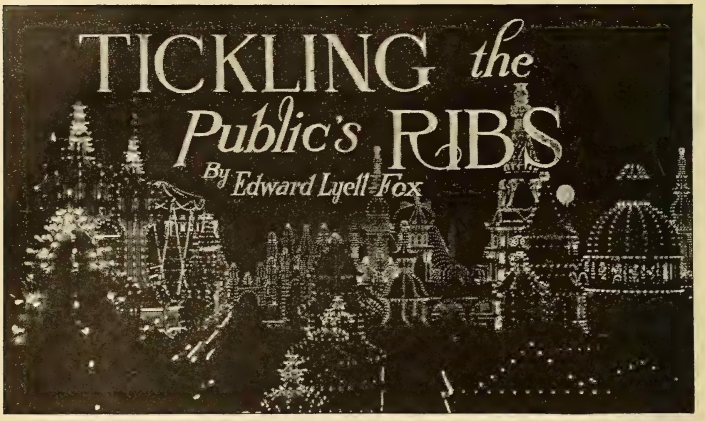
The word "turbine" seems to have been applied to a water wheel upon a vertical shaft in which the water by pressure or impulse acted upon the entire circumference of the wheel, coming either from the outside or from within and discharging accordingly.

Europe has done more than this country in the past to perfect the turbine, but of late years American builders, waking up, have designed and installed some of the best of water turbines, some very massive as indicated above.

Insulation from Seaweed

A new product, based on common seaweed, which is found in such unlimited abundance, is announced as the result of many years of experimenting in England. Many scientists have foreseen the enormous possibilities afforded by seaweed, and the material just discovered, called seagumite, bids fair to exceed all expectations, as it is of special value in all electrical industries, being a non-inflammable insulation of high dielectric strength, proof against heat, cold, oils and weather. A singular property is the increase of insulation resistance following immersion in water. The material is unaffected by dilute sulphuric acid, which makes it well adapted to storage battery jars and separators. Among associated mechanical uses, seagumite seems well adapted for motor gears, switchboard panels, switch handles, steam and gas packing, especially for high pressures. The product is also well suited to replace leather in belting.

Do not forget the comfort a fan in the kitchen may afford by exhausting the hot air and kitchen odors, to the outside, or by forcing in the cooler breezes.



Do you know that electricity has made possible Coney Island not only by night but by day? Do you know that the Borealis, flashing over it nightly, has been an important factor in its development; that the wheels of all the great amusement parks are driven by the power that is generated in dynamos? Consider that it costs $3,000 a night to light its wooden spires; that these are ablaze 140 nights a year, making the bill of $450,000. Do you know that a man with a headful of figures has computed that if all the electric bulbs of Coney Island were placed in a line 30 feet apart that they would illuminate the way from New York to San Francisco? Surely you will admit it is indeed the City of Electricity.

Paris has a carnival in Mid-Lent, but New York has one every day from the middle of May to the middle of September. Last year 20,000,000 people took part. They came from all parts of the country. Coney Island, you see, is a national show place like Yellowstone Park, like Niagara Falls. Also, the same people spent $45,000,000, according to the adding machines, and adding machines do not lie.

Unlike Gaul, all Coney is divided into four parts—Steeplechase, Luna, Dreamland and the section of general shows. These, taken one at a time, show their dependence to a remarkable extent upon electricity. Let me illustrate:

If you happen to be in Steeplechase Park some day, you may notice a blue-eyed, bristling red-moustached man whose hair, seemingly damp, gives one the impression that he is always working. He is George C. Tilyou. Tilyou, the proprietor of Steeplechase, was one of the first men to recognize the value of electricity for amusement park purposes. When he was three years old he went to live at Coney Island with his folks. School days over, he became interested in real estate and finally organized the old Surf theatre on the Bowery. Also, Tilyou ran a clean show. At that time John McKane, the political boss of Coney Island, wanted the other type of show. He could obtain graft from it. So he and Tilyou began to fight. Twice Tilyou lost all he had, but finally he won out. McKane went to the penitentiary for ballot box stuffing. And this is why Tilyou won out:

One day as he was walking along the beach he saw some youngsters playing around an upturned cart. They had rigged up a platform on its wheel and

spun this around until one of their number flew off, falling on the sand. Instantly there came to Tilyou the idea of the "Human Roulette Wheel." Using the principle of centrifugal force, he built a huge wheel of smooth wood and about it a wall of cushions. To the wheel was attached an electric motor which made the wheel revolve, accelerating at every revolution. People paid ten cents for the privilege of sitting on this wheel and finally being hurled off into the cushions. This netted Tilyou $50,000 and was the start of his successful Steeplechase Park.

GEORGE C. TILYOU—BUILDER OF THE NEW STEEPLECHASE

Also, it is very significant that the other big attraction of the park is run by the same power. This is the "Steeplechase," from which the place took its name. One day Tilyou sat watching a merry-go-round. He looked idle but his brain was busy. On this particular merry-go-round the wooden horses moved up and down. There was a crowd waiting to ride them, but at the merry-go-round across the street, where the horses were stationary, there was nobody. The proprietor of the successful merry-go-round came to Tilyou and said:

"The reason for my success is that the people want all the action they can get. They like the idea of jerking up and down as well as going round and round."

And, as the organ from the failure across the street creaked dismally, Tilyou thought.

"Why wouldn't a contrivance on which the wooden horses run a race be even more popular?"

Not being able to answer the question in the negative, Tilyou went to work on his invention. At the end of a half year he gave to Coney Island the Steeplechase. This was a loop of track, uphill and down, under bridges and over them, on which six wooden horses, operating on the principle of the cable car, raced; and it earned a fortune.

But let us walk up Surf Avenue, the aorta of the Island, until we come to Luna Park—a wonderful place of papier-mache, mountains and valleys, minarets and and towers, streets of quaint wooden pagodas. This is the place where nearly a million and a half electric light bulbs burn nightly, where the power used is enough to illuminate a city of 400,000 souls, where electricity, as an agent in producing illusions, is seen at its best.

In the beginning was Frederic Thompson, a young mining engineer of Nashville, Tenn. Every once in a while you read of Thompson failing, going into bankruptcy; but always he comes to the front again, stronger than ever. Over ten years ago he obtained the use of one of the big exposition buildings at Nashville. In it he staged his "Trip to the Moon," an illusion in which the scenery revolved downwards, giving the passengers aboard his stationary airship the impression that they were being lifted into space. Wonderful light effects were obtained by dexterous use of violet and pink shades. From Nashville he took his "Trip to the Moon" to the Pan-American Exposition, and meeting there Elmer Dundy they decided to try it on New York. On May 16, 1902, they organized Luna Park, which was named, not after the "Trip to the Moon" but after Dundy's little sister. Their big electrical illusion was the attraction, however, and at the end of the year they had realized 90 per cent on their

THE HUMAN ROULETTE WHEEL NETTED TILYOU $50,000 AND WAS THE START OF THE STEEPLECHASE PARK

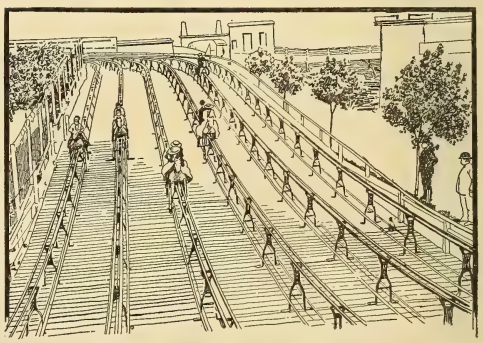
original investment of two and one-half million dollars.

From that first successful use of electricity grew the many attractions of the park.

Take the "trick walk" that one encounters shortly after entering. The planks of this spread in all directions as one moves forward, being jerked by a series of levers connected with a motor. So with the "Witching Waves"—a canvas covered surface made to undulate in a similar manner. Over this surface cars full of laughing passengers rock to and fro.

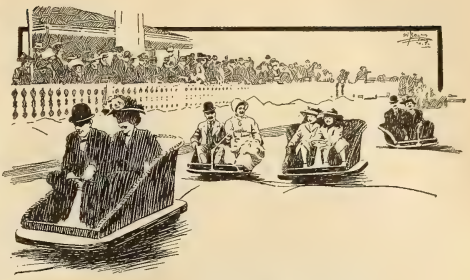
But electricity was carried to bigger things. One day Thompson thought it would be a good idea to show the public what damage could be done by a tremendous volume of water, suddenly turned loose. He spent $200,000 doing that and made as much more. He called his new attraction the "Crack of Doom." By means of powerful electric pumps he drew daily a million gallons of water from the ocean into a great reservoir. The water came, 65,000 gallons every minute, through 22-inch mains. Then the reservoir was decorated to represent a mountain and below it was built a ten foot tank at the top of which was a mining town in miniature. When the show began the audience saw the town at sunset. The lighting effects used by theatrical men were made doubly effective through Thompson's skill. Gradually the painted sky darkened into night; one by one lights began to twinkle in the little houses, scenes of riot and dissipation came into being throughout the camp—some Gomorrah of the Northwest. Then, when the orgies were at their height, a judgment in the form of a sudden deluge was visited upon the place. Behind the scenes a man pressed a button and, the reservoir opening automatically, the water came hissing and tumbling down, sweeping everything before it and tumbling the little houses in a dark surge.

It has been said of Thompson that his psychological recipe for amusement park success is "let the crowd amuse itself." He does that with his "helter-skelter," a cane slide down which people



SIX WOODEN HORSES OPERATED ON THE PRINCIPLE OF A CABLE CAR EARNED A FORTUNE

shoot amid the laughter of hundreds looking on. In nearly every other case, however, he calls upon electricity to help the crowd in the unconscious task of "amusing itself." Yes, Thompson is enamored of electricity. Last year he even went so far as to do away with the little steam railroad that ran around Luna and in its place installed an electric system. Now he has two roads, two third-rails and two double end motor cabs.



A RIDE ON THE WITCHING WAVES

So it is with Dreamland. Its great tower formerly ablaze with thousands of lights hints that electricity is the keynote of the place just as it is at the other two parts. They'd no use for steam power of any kind. They even had a Hall of Electricity, in which one could be shocked for the asking and view all sorts of great apparatus to say nothing of electrical curling irons. Then they had their big illusion like the one at Luna. Only here it was called "The Fall of Pompeii" and an electrical volcano got in its work after vari-colored electric lights have shown the city in beautiful hues. And there's "Creation" too, the only constructive show of the spectacular type. It too, however, was dependent upon electrical effects.

But let us leave these three great parks. We have seen that their success depends wholly upon electricity. Now let us visit the swarm of general attractions scattered throughout the Island. Most important among them is the Scenic Railway. Of this there are two types—the one in which the cars are motor driven, and the gravity railroad. Of course the former type is using electricity all the time. The latter, though, employs it as well. By cables the cars are carried to the top of high points, where they gain the potentiality for their wild dashes up and down and around.

Also, we find in many of the side shows up-to-date uses of electricity. There are glass palaces, of many colored lights, and stairways, their steps charged with electricity, giving the walker the sensation of countless needles entering the soles of his feet.

And because of electricity Coney Island is a success—such a success that twenty million people visit it every year, spending $2.25 apiece. The whole proposition would be regarded by a hard-headed business man as a gamble. But the splendid audacity of the showman makes a surety. In his weird city of make-believe he gives wild license to the imagination and pays cash to bear out his theories that the public wants to amuse itself in the most ridiculous manner.

Carnival at Nice

Some notable features were produced in the floats shown at the Nice Carnival, in France, this year, the floats being so made that they could be used in an electric parade following the day parade. Nearly all the floats, some of which were very elaborate and costly, were trimmed with row after row of electric light bulbs, the floats carrying powerful batteries concealed beneath the decorations. One float which attracted much attention was a satire on well-known French officials. One huge figure sat in front holding a huge imitation electric lamp, studded with small globes, his cocked hat also being studded with electric lights. A figure sitting over one wheel had half the body sticking through a picture frame, with electric lights around the edge of the frame.

Another float represented a huge fish overwhelming a small boat in which were figures holding blades aloft. Rows of lights along the gunwale of the boat and down the edges of the oarblades were lighted at night. Huge spiders with electric light eyes crawled in the sand beneath the stern of the boat.

SOME VIEWS OF THE ELECTRICAL PAGEANT AT NICE

One of the most striking floats represented King Carnival riding in his carriage drawn by a horse wearing a summer sun hat. The King wore a light studded crown and carried a light studded scepter. The dummy driver's hat was fringed with light bulbs and the carriage, shafts and harness of the horse were also covered with them. This float was drawn by six horses in white trappings.

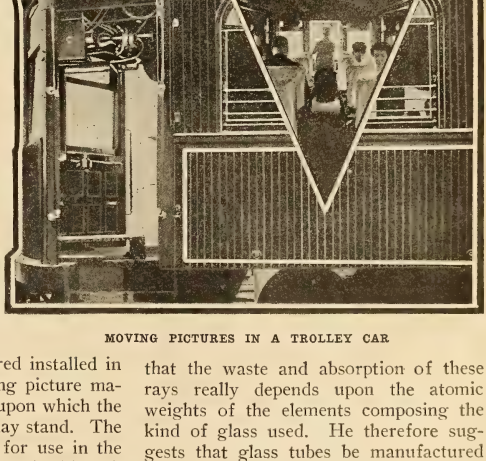
Another striking feature was a half dozen walking lamp-posts. These were hollow and contained a man hidden

within as the motive power. On the front of each was a face and a small battery at night lighted up the transparent tops. Electric lights were profusely used about the buildings along the streets and about the square, over the route of the carnival procession.

Moving Picture Theater in Trolley Car

The Pittsburgh, Harmony, Butler and Newcastle Electric Railway has put in service on its road a special car in which moving pictures are exhibited for the entertainment of its passengers during trips. Of the many schemes called into service for the entertainment of the traveling public this is certainly the most unique and marks the entrance of the moving picture into another field. The car in which the pictures are exhibited is not run regularly, but is used for the accommodation of special parties by whom it is chartered for a certain run. Being badly damaged in collision with another car, the superintendent in having it repaired installed in the rear platform a moving picture machine, with a small bench upon which the operator of the machine may stand. The machine draws its power for use in the arc light from the trolley and, although the power varies with the amount consumed by the car, there is little or no flicker.

When the pictures are to be exhibited, the screen is first lowered just back of the motorman. This is opaque, so that no light penetrates it and interferes with the motorman in his cab. The electric lights in the car are turned out, window curtains are drawn, and the car resembles a small moving picture theater.



MOVING PICTURES IN A TROLLEY CAR

Absorption in X-ray Tubes

As usually known, X-rays arise in vacuum globes called Crookes tubes, just where the rays from the cathode strike a piece of platinum, tungsten, or molybdenum, called the anti-cathode.

Roentgen rays differ from light rays in being short pulsations instead of continued waves. Hitherto, the Crookes tubes, which give X-rays, have absorbed as high as 70 per cent of these valuable rays.

Sir J. J. Thomson has just discovered that the waste and absorption of these rays really depends upon the atomic weights of the elements composing the kind of glass used. He therefore suggests that glass tubes be manufactured with elements of the lightest weight. This has been applied now practically by using a glass composed of lithium, beryllium and boron, with a combined atomic weight of 27, in place of calcium, silicon and sodium glass, whose combined weights are 92.

As a result, when these new glass tubes are used, only about fifteen or 20 per cent of the rays are lost.—L. K. Hirshberg, A. B., M. D. (Johns Hopkins).

Electrical Display Accompanying Mt. Taal Eruption

Some 37 miles south of Manila in the Philippine Islands is Bombon Lake with Volcano Island in its middle. The soil of this island is rich, but only the most courageous of the Filipino farmers cultivate it because of fear that one day Taal volcano, which has wrought destruction many times before, will again become active.

The earliest eruption is recorded by the Augustinian friars 340 years ago. "There is a volcano of fire which is wont to spit forth many and very large rocks, which are glowing, and destroy the crops of the natives," read the records. Something like eighteen times Taal has belched forth, the last disturbance occurring in January, 1911. A description of this destructive eruption and the unusual electrical phenomena accompanying it is given in the *National Geographic Magazine* by Dean C. Worcester.

"Taal continued unusually quiet until January, 1911. During the night of the 27th of that month the seismographs at the Manila Observatory commenced to register frequent disturbances, which were at first of insignificant importance, but increased rapidly in frequency and intensity. The total recorded shocks on that day numbered 26. During the 28th there were recorded 217 distinct shocks, of which 135 were microseismic, while ten were quite severe. The frequent and increasingly strong earthquakes caused much alarm at Manila, but the observatory staff was soon able to locate their epicenter in the region of Taal volcano and to assure the public that Manila was in no danger, as Taal is distant from it some 37 miles.

"Definite news that Taal was in eruption was received during the morning of January 28, in a telegram to the Director of the Bureau of Science from Mr. J. D. Ward, who conducts tourists to the volcano. Mr. Charles Martin, the government photographer, left for the scene of disturbance at three p. m., reaching the edge of Bombon Lake at eight p. m.

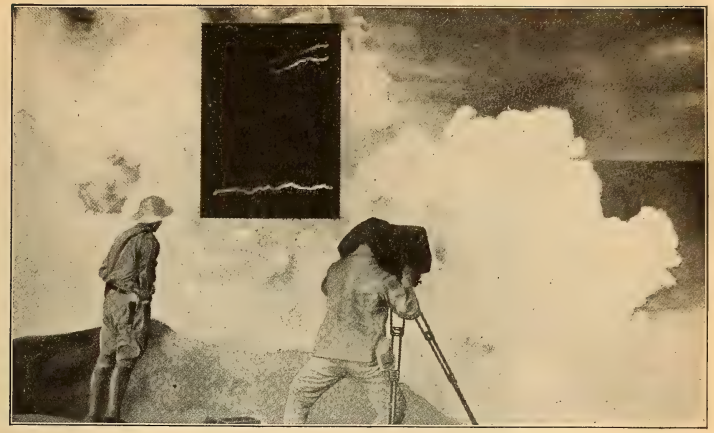
"He had been sent to obtain a photographic record of the phenomena of this eruption, which no one anticipated would be destructive, and he proceeded to perform his appointed task with extraordinary coolness, and with complete disregard for his personal safety. It is due to the merest chance that he is alive today.

"Early in the morning of January 29 he crossed the disturbed waters of Bombon Lake in Mr. Ward's boat and by eight o'clock had made his way to the crater rim, from which point he secured a magnificent series of photographs giving an impressive idea of the play of titanic forces which was then occurring.

"The varied phases of this imposing display tempted Mr. Martin to expose plates until his stock became practically exhausted, when he returned to Tanauan with but a single plate ready for use.

"At 1:05 on the following morning he was awakened by an extraordinarily heavy explosion, and saw an enormous column of mud rising from the crater, which was distant some eleven miles. There was a magnificent display of 'chain' lightning about the black mud cloud, and the explosion had awakened and terrified every one. Twelve minutes later there was a rain of mud at Tanauan. It was followed by a fall of fine, dry volcanic ejecta. Shortly before two o'clock the sky, which had been obscured by the black mud cloud, cleared completely.

"While Mr. Martin and his companions were still discussing the imposing phenomenon which they had witnessed, there occurred at 2:20 two terrific explosions, or I should perhaps say a double explosion, for the second report succeeded the first so quickly as almost to coincide with it, and people a little further away noted but one concussion. We now know that this explosion tore most of the floor out of the main crater of Taal volcano and hurled it skyward. A huge black cloud continued to rise for



GOVERNMENT PHOTOGRAPHER MARTIN AND GEOLOGIST PRATT ON THE EDGE OF THE CRATER OF THE TAAL VOLCANO. THE PHOTOGRAPH OF LIGHTNING FLASHES IS REDUCED TO ONE-THIRD SIZE—THEY WERE FIVE MILES FROM THE CAMERA

a long time. Its ejection was attended by a most extraordinary electrical display, which was visible for 250 miles.

"The explosion was heard over an area more than 600 miles in diameter. In the subprovince of Kalinga the wild men thought that the dynamite stored at Lubuagan by the government for use in road construction had exploded, and throughout the following day delegations from various settlements visited the town to ask if this was the case.

"Mr. Martin says that the cloud at first rose steadily, but 'soon the wind got hold of it and it spread out all over the country, leaving us in total darkness. Wet mud started to come down in Tanauan twelve minutes after the explosion.

"In Manila the shock of the explosion was so great that people leaped from their beds in terror, thinking that there had been some great catastrophe in the city. Their attention was instantly attracted by the glare of the electrical display, and many of them realized that Taal must be in full eruption. The thousands who witnessed the extraordinary sight agree that it beggared description, and few of them have even attempted to describe it. The streams of electric fluid seemed to be of extraordinary breadth.

"With the instinct of the photographer still alert, Mr. Martin exposed his one remaining plate; but, unfortunately, in the excitement of the moment he failed to realize that a flash of lightning makes its own exposure; and, fearing that the steady glare resulting from the myriad discharges would fog his plate, timed his shutter to one six-hundredth of a second, with the result here reproduced.

"When it is remembered that these flashes were taken at a distance of some five miles through a lens with a focal length of 300 millimeters, and that the photograph is here reproduced one-third size, some idea will be gained of the breadth of the discharges.

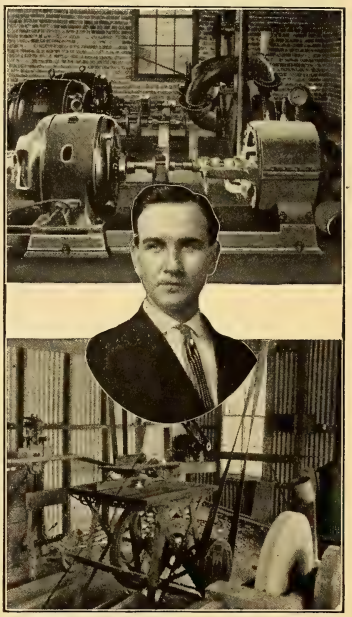
"The thousands upon thousands of people who were awakened by the final explosion in time to see the enormous column of ejecta shooting up from Taal, and to witness the extraordinary attendant electrical display, little dreamed that in the twinkling of an eye some 1,400 human beings had perished."

Electrifying a City

It is no small undertaking to electrify a single building, even under favorable conditions, and the man who would undertake, and carry to successful completion, the electrification of a city of 2,100 people must be energetic, resourceful, well trained.

Such a man is George Edward Johnson and the city to which he first applied his principles is Sabetha, Kan.

The lighting plant at Sabetha, when Mr. Johnson took charge, had been operating under municipal direction, and at a loss, for nine years. With a definite idea in mind and with carefully thought out plans he set about reorganizing and improving the central station service. How well he has succeeded may be appreciated from the fact that out of the total 700 houses in the place 600 are taking current and use in the aggregate 7,000 lamps in the stores, factories and houses. There are also 600 motors in use, driving every conceivable appliance for the lessening of manual labor on the farm, about the house and in the factory.



GEORGE EDWARD JOHNSON, ELECTRIFIER OF CITIES, AND EXAMPLES OF HIS WORK IN SABETHA, KANSAS

The first great work of putting the plant on an efficient and business basis was successfully accomplished at an outlay of $8,000, devoted mainly to new and modern apparatus, and the task then presented itself of building up an adequate consumer load that would tax the capacity of the machines. The most important step was, after the introduction of the electric light into a major portion of the homes and factories, the application of the electric motor to the various power uses of the city. The city itself led the way by installing a complete equipment of electric motors to drive all its pumps and furnish its entire water supply. All the water the citizens use is also obtained by electric pumps, and at the most reasonable rates.

So satisfactory was the city's venture that motors of the same type were soon installed wherever the need for power existed, and only a short time ago the last gasoline engine power plant was sold and the money used to buy an electric motor.

Mr. Johnson, having started the larger users of current in the right direction, went after the grocers, carpenters, butchers and other trades people in the city and also after the farmers in the outlying districts. It was in one of these latter campaigns the Sabetha plant secured as

a customer the entire town of Morrill. Practically all the storekeepers in Sabetha use electricity and reap the consequent advantages as do the storekeepers in the large cities.

Even the small and unpretentious carpenter shop has its motor. The one illustrated is some distance out of the city and the single phase motor is connected to the same transformer that carries the lights of a number of dwellings, but no disturbance is noticeable on these lines when the motor is started.

The next and final step in the electrification was the introduction of current devices other than lamps into the homes of the city. Mr. Johnson, with the coöperation of Mrs. Johnson, a graduate engineer, by the way, equipped their house with every modern electrical device that could be obtained, and aside from the regular use of the various appliances, gave special demonstrations of the more popular pieces, such as flat irons, fans, washing machines, curling irons, etc. It was not long before a demand was worked up for these handy household current-consuming devices.

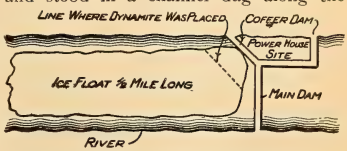
Finding that he still had some steam to spare even at the peak of the load, and that lots went to waste, exhaust pipe lines were laid, radiators bought at wholesale, and the city homes are now users of central station steam heat as well as current. There still being some exhaust steam to spare, arrangements were made to sell it to a big laundry and to an ice plant, so that they would use not only the electricity the plant made but also the steam it would have ordinarily wasted.

The Invention of the Acousticon

The Dictograph which has become so prominent in the last six months and which was described in the June issue under the title "Eavesdropping by Science" is but an adaptation of the acousticon which was invented some ten years ago by Mr. Miller Reese Hutchison, as the technical press of that period will indicate. Therefore, the statement in the above mentioned article, to the effect that the acousticon and interior telephone were invented by Mr. Turner, is an error, which we take this opportunity to correct.

Saving a Power House From the Ice

Last spring a new power house was in course of construction on the Kankakee River. It was only about half completed and the steel framework was already in and stood in a channel dug along the



HOW THE ICE TROUBLE WAS AVERTED

one side of the river to a depth of 50 feet below the water level. The water was kept out of the channel by cofferdams built all around it, as shown in the sketch.

Ice had coated the river to a depth of sixteen inches and when this began to go out a lot of trouble was experienced. One afternoon a large ice sheet, fully a half mile long and the width of the river, came down and lodged against the upstream cofferdam in such a way that the whole weight of the float rested against the dam. Smaller pieces coming down the river piled up against the large float, which gradually increased the pressure until the cofferdam began to give.

Dynamite was freely used to break up the ice by laying five or six sticks on the ice in a line and lighting the fuses with a match. This scheme, however, did not work, as they could not shoot off enough at one time.

They then decided to place a row of sticks half way across the river on the side resting against the cofferdam and shoot them all off at once by means of electric current. This was successfully accomplished and the cofferdam relieved of the enormous pressure in time to save the plant.

Electrical Colloids

By DR. LEONARD KEENE HIRSCHBERG,
A. M., M. D. (Johns Hopkins)

The introduction of the metallic colloids into medicine constitutes a new departure, the significance of which is not generally recognized.

Colloids are substances that will not pass through an animal membrane, of which gelatin, albumin, and white of egg are typical instances. Until recently this was about all that was known of them, although, as the animal organism is wholly composed of colloids, it is only by a thorough knowledge of their interaction that the reactions taking place in the human organism can be understood.

The discovery that it is possible to convert certain metals and metallic salts into the colloid state, and the careful study of these metallic colloids, however, show that they are reduced to infinitely small particles. Some idea of the minuteness of these particles can be gathered from the fact that a cubic millimeter of ordinary colloidal gold is estimated to contain 1,000,000,000 of them, and what would be considered a solution of fine particles at least twice that number. These granules are animated by what is known as Browian movement and are enabled to remain in suspension in a liquid medium almost indefinitely, their stability depending on the size of the granules, the nature of the body and of the vehicle employed. It is interesting to note that the number of granules varies according to the cube of their size, so that if their size be reduced to one-half, their number is multiplied by eight, a fact of considerable practical importance because the activity of these solutions depends upon the multiplication of these centers of activity.

There are two principal ways of producing metallic colloids, viz., chemical and physical (electrical). The chemical preparation of a colloid metal is effected by the slow reduction of a salt of the metal, as, for instance, by treating nitrate of silver with a mixture of sulphate of iron and citrate of soda. The physical method consists in passing the electric arc between electrodes of the metal to be converted into colloid, plunged into distilled water. Under these conditions the electrodes throw off an extremely fine powder which remains suspended in the liquid. The two methods of production yield widely different results, and from a therapeutical point of view I need only deal with the electric colloid metals, since only these present the necessary homogeneity, minuteness of granules, purity, and stability.

A solution of electric colloid silver (small-grained) is of a brownish-red color (the solution with larger grains has a green tinge). It diffuses light and is vaguely opalescent. For therapeutical purposes it is made stable by modifying the composition of the aqueous medium and is rendered isotonic with blood serum by the addition of sea salt. Thus prepared for use, it is known as electrargol, and is one of a series, electraurol, electroplatinol, electromercurol, etc., which all appear to possess the same properties in approximately the same degree, a fact which militates in favor of the view that it is the physical state of the substance rather than its nature that determines its effects. These colloid metals, like colloids in general, have a special electric charge, and thanks to their state of fine divisions they possess a certain catalytic power—that is to say, by their mere presence they can determine very powerful chemical action out of all proportion with the quantity of matter brought to bear. From this point of view the action of colloids resembles that of the ferments.

Although of comparatively recent introduction, the medical applications of the colloid metals are numerous and

interesting; indeed, their employment inaugurates a fresh chapter in medicine.

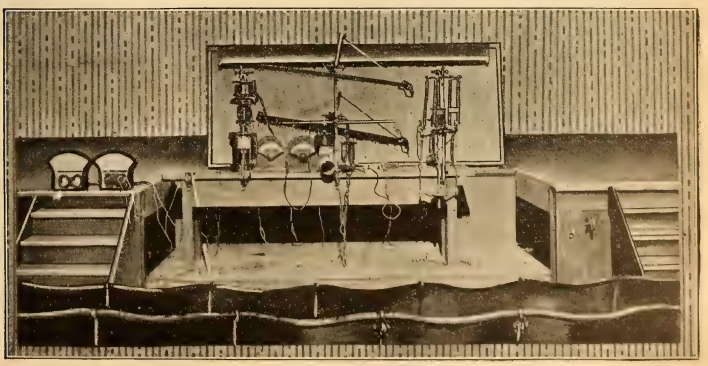
Speaking generally, the colloidal metals are especially remarkable for their beneficial action in infective states — blood poisoning by germs. This action has been shown to be due to their stimulating influence and to their destructive effects on micro-organisms and their toxins as shown by the immediate fall of temperature, and the subsidence of the constitutional symptoms of intoxication. They are employed as a rule for the sake of their constitutional effects, for which purpose an injection of from five to 20 c. c. is made into muscle or, in urgent cases, into the veins.

Even more interesting are the results obtained in acute meningitis and in epidemic cerebro-spinal meningitis. In the latter, electrargol can be employed either alone or in conjunction with the serum treatment. The injection is usually intravenous, but in severe cases it should be made directly into the spinal canal so as to obtain immediate effects.

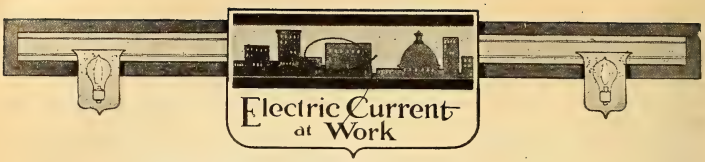
A DISAPPEARING LABORATORY TABLE

At the Lewis Institute, Chicago, a novel means is provided for handling experimental apparatus in classes in electricity and physics. The laboratory is located in the basement under the auditorium. The lectures are delivered in the auditorium above. Under Professor Woodworth's direction a section of the front portion of the stage was arranged upon hinges so as to drop down while the front portion lays forward upon the floor. An elevator was installed which runs from the floor level of the basement up to the stage level. After the apparatus has been placed upon the elevator platform in the basement and with the hinged parts of the stage out of the way, the elevator lifts the apparatus into the auditorium and to any height convenient for demonstrating.

As shown in the illustration, the elevator platform is equipped with a regular laboratory table to which are attached connections for providing electricity, gas, air and water. The apparatus shown is that used in a lecture upon arc lamps and includes three types of arc lamps, a mercury vapor lamp and instruments for measuring voltage and current.—Clarence M. Bartelme.



A DISAPPEARING LABORATORY TABLE



The New Edison Rectifier

By W. H. MEADOWCROFT

Without question, the owner of an automobile would regard it as an ideal condition of affairs if he were able to run electric lights in his car, operate his ignition system and automatically start his machine from one common source of supply, which could be constantly renewed by him at his home without trouble and at small expense.

All this, however, is only possible by the use of storage batteries, the great drawback to the extensive use of which has been the lack of practically universal facilities for recharging. Where direct current is available this presents no difficulty at all, but the major proportion of the public electric circuits supply only alternating current, which, of course, cannot be used for charging storage batteries, except through the medium of motor-generators or rectifiers of various types.

An alternating current rectifier has been developed at the Edison Laboratory after a long and persistent series of experiments made to determine the most reliable and efficient means of charging a storage battery from an alternating current circuit. And, moreover, it has been designed to meet the needs of the average automobile owner who may be the merest tyro as regards electrical apparatus.

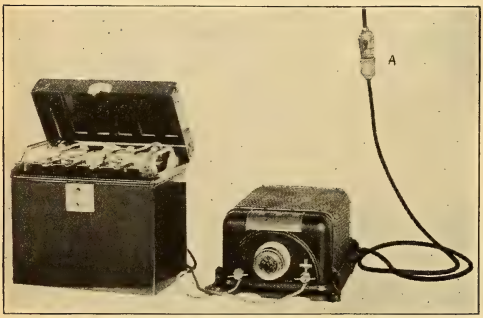


FIG. 1. THE NEW EDISON RECTIFIER

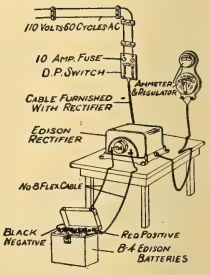


FIG 2. CONNECTIONS OF RECTIFIER

The new rectifier in theory and in fact is a simple electro-mechanical valve which allows current waves of only one polarity to pass through it from an alternating current circuit to the battery which is to be charged. It consists of an arrangement of vibrators controlled by magnets, with a capacity device in circuit. The charging current begins and ends exactly at the commencement and closing of the positive wave, hence there

is absolutely no spark when the rectifier is in operation. Edison, with his accustomed thoroughness, has been running one of these devices on a destructive test, but thus far has not succeeded in breaking it down, although it has been in operation continuously for more than 5000 hours, delivering its full load of current and requiring no stoppage for repairs or adjustment in all that time. This is equal to several years' duty in ordinary charging service for automobile use.

The method of operating it is as simple as the turning on and off of an ordinary electric light. An indicating snap switch of the usual form controls the starting and stopping of the charging current. This rectifier will run continuously, giving any desired charging rate of current within its rated capacity. There being no commutator, brushes, bearings, vacuum tubes, or special starting devices, there is no need of an expert's services to operate it or to keep it in good running condition.

Figure 1 shows a small size of Edison's rectifier connected up and charging an ignition battery of five cells of Edison storage battery. It will be seen that the connections are exceedingly simple, consisting of the usual connecting cord and plug at (A), and a charging lead running from the positive side of the charging terminals on the rectifier to the positive pole of the battery, and another lead connecting the negative terminals, as shown.

On turning the snap switch to the "on" position, the proper charging current will flow into the battery. When the charging is completed, the switch is turned to the "off" position and the battery leads are disconnected. Any battery will charge in just the same time on the Edison rectifier as though it were running on an ordinary direct current charging circuit.

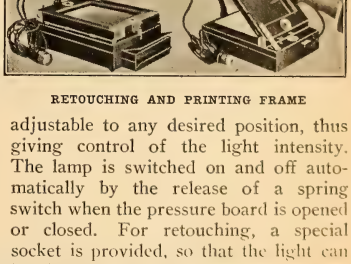
A larger size of this rectifier, for 20 amperes capacity, is made for charging two sets of battery, and in this case, in order to insure correct adjustment of the charging current, a regulating rheostat and ammeter is connected in the charging circuit.

Figure 2 shows a plan of connections for this rectifier. In this instance the rectifier is connected to a wall receptacle of the ordinary type and the circuit goes through a small switch and cut-out. This makes a permanent and reliable connection, easy to install and free from accidents. With batteries of the lead-acid type, the use of a regulating rheostat and ammeter in the charging circuit is advisable.

The usefulness of this rectifier is not limited to the charging of storage batteries, as it may also be employed to furnish direct current from an alternating circuit to any electrical device connected with it. For example, it can be used to advantage to operate a direct current arc-light for the illumination of motion picture machines and stereopticons; also for operating railway signals, and telegraph and telephone apparatus.

Retouching and Printing Frame

The illustration shows an equipment for the rapid printing of post cards and developing papers. The light bracket is



RETOUCHING AND PRINTING FRAME

adjustable to any desired position, thus giving control of the light intensity. The lamp is switched on and off automatically by the release of a spring switch when the pressure board is opened or closed. For retouching, a special socket is provided, so that the light can be placed just behind the frame and reflected to the negative by a white enameled reflector.

A Self-Supported Telephone

It is often a great convenience to be able to use both hands while carrying on

SELF-SUPPORTED TELEPHONE

a conversation over the telephone. The Van Akin combined transmitter and receiver permits this by having a substantial and adjustable support.

Auristophone Annunciator for Limousines

Those who are so fortunate as to own limousine cars will find the Auristophone electric, loud speaking annunciator an improvement over the old-fashioned Dutchman's pipe megaphone for giving orders to the chauffeur. The system consists of a voice receiving instrument or transmitter carried in a little pocket in convenient reach of the passenger. This is connected through a cell or two of battery with a reproducer affixed to an amplifier in the chauffeur's compartment. The chauffeur can hear the passenger's voice readily and without putting a receiver to his ear. In reality it is a loud speaking telephone and can be used for various other purposes, as in public passenger cars to announce streets, in restaurant kitchens to receive meal orders, in private homes for use between rooms, between offices as an intercommunicating telephone, etc.

Stranded Wire Tips

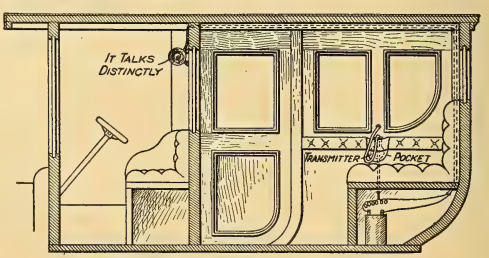
It is frequently convenient to have stranded wires transformed into solid terminals. Here is a special Fahnestock tip which does the trick in a simple manner. Hold the tip in a gas or candle flame, using a pair of tweezers or pliers

STRANDED WIRE TIP

until the solder already inside it melts. When the solder melts push the end of the wire into the tip. When the solder cools, the wire will be soldered securely to the inside of the tip.

Demand in India for Electricity

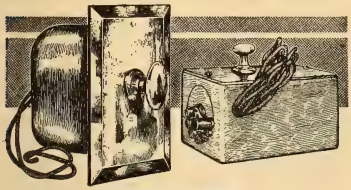
In Bombay, India, according to the German consul, the new dwellings and offices are nearly all fitted with electric light and electric fans, and some also with electric lifts. Hardly less important than lighting is the demand in the bungalows for electric fans. Where electric power is available, there is in every room an electric fan attached to the ceiling, and generally there are also small portable lamps. There is also a large demand for electric machinery for power plants. Not the least important part of this demand is for the textile factories in Bombay, and it may be anticipated that in a few years most, if not all, of the larger spinning and weaving mills, at least, will be run by electric power.



ANNUNCIATOR MOUNTED IN A LIMOUSINE

A Magneto Doorbell

It is well known that the battery is the most troublesome part of a bell system. To overcome this feature a new device, recently designed, makes use of a magneto. When the knob which replaces the familiar push button is given a slight turn, current sufficient to operate the bell, which is furnished with the magneto, is generated.

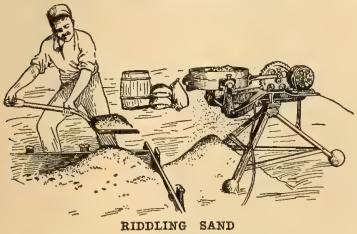


MAGNETO DOORBELL

For offices, a selective switch is provided, so that any one of a number of bells may be rung from the same magneto.

Riddling Sand by Electricity

The molding and core sands used in the foundry are prepared by sifting them through a screen or "riddle" to make all of the same consistency and to remove the coarser parts. This is usually done by hand or by pneumatically operated riddles.

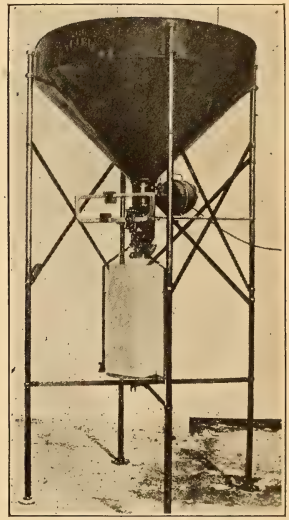


RIDDLING SAND

The illustration shows a one-third horsepower motor applied to shake the riddle. The ordinary eighteen inch foundry riddle fits the clamping device and the amount of work possible is increased 50 per cent over the old method.

Automatic Weighing Machine

Sugar refineries, wholesale groceries, canneries, candy factories, bakeries, etc., wherever large quantities of sugar are handled, have long felt the need of a practical weighing machine. Such a machine is now on the market, embodying a novel motor application. The motor drives an agitator which stirs the sugar and insures an even flow and correct weight at all times by the prevention of lumping and clogging in the hopper.



AUTOMATIC WEIGHING MACHINE

An advantage lies in the uniformity of the weighing. When the weighing beam is set at five pounds, for instance, the package is sure to contain exactly that amount—no more, no less—while with hand weighing it is next to impossible to give exactly the same uniform weight.

The Westinghouse motor is of 1/20 horsepower, applied directly to the weighing mechanism at the bottom of the hopper and is connected to the agitator by

means of a worm and gear. The motor control is effected entirely by the weighing beam.

When the weighing beam comes to a horizontal position, a switch is closed, which starts the motor; and when the required amount of sugar has passed from the receptacle, the weighing beam drops to an inclined position, thereby stopping the flow of sugar, and at the same time opening the switch and stopping the motor.

Pressing Clothes by Magnetism

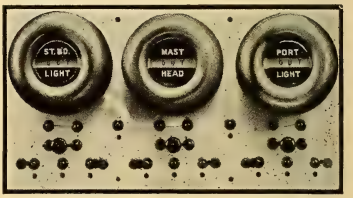
In striking contrast with the old style pressing iron is the easily operated magnet controlled iron. With the old type iron a man's full weight is often needed to properly press out the seams and edges on a newly made garment. With the magnet controlled iron the pressure may be varied from one to 8,000 pounds by a readily moved counterbalanced foot control. This lever moves an arm over contacts which energize more or fewer coils, according to the pressure which is desired.

The current consumed is equivalent to that required by two sixteen candlepower carbon lamps.

MAGNET CONTROLLED IRONS AT WORK

Ship Automatic Tell-tale System

It is not generally realized that masts, relics of the old sailing boat days, are still used on steamboats as a means for carrying signal lights. These lights, and certain others, must be kept burning during the night, and some nations have laws which require automatic devices such as are here illustrated to give warning in case these lights go out. When an automatic tell-tale is used, each signal lantern is provided with two incandescent lamps connected to this board and in turn to the lighting circuit. The regular light is thrown into circuit by the switch on the board, and should this light burn out, or the circuit controlling it become interrupted, a small light on the indicator board is thrown in, the annunciator drops from "Burning" to "Out," and the buzzer is set going. At the same time the relay provided in the instrument throws in the second or auxiliary lamp, maintaining the lantern lighted.



AUTOMATIC TELL-TALE SYSTEM

While it is desirable to replace the original or burned-out lamp as soon as possible, in the case of a storm where it would be impracticable to get at the lantern, the auxiliary light can be left burning until the other is replaced, in which case the indicator will continue to indicate that the original lamp is not lighted.

Electric Heaters in a Water Tank

Located high above the streets of New York on top of the Trinity Corporation Building and exposed to the cold winds from over the North River stands a great water tank for fire protection in

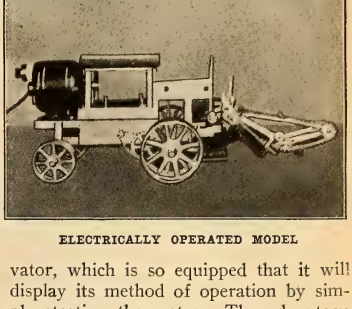
WATER TANK WHICH IS HEATED BY ELECTRICITY

the building it surmounts. This tank is connected to pipes which convey the water to sprinklers in case of fire.

To prevent the water in the tank from freezing electric heaters were installed, after much experimenting. It was found that the heaters worked most effectively when set in the eighteen-inch air chamber at the top of the tank and attached to the underside of the air-tight cover. Four heaters of 1,200 watts each were installed by electricians, with a thermostatic control.

Electric Motor Operates Model

A practical use for the small electric motor is shown in the photograph of a miniature working model of an exca-

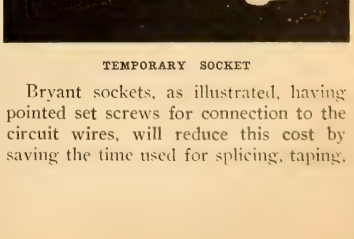


ELECTRICALLY OPERATED MODEL

vator, which is so equipped that it will display its method of operation by simply starting the motor. The advantage is obvious, as an inventor can make a much more convincing exhibition of his model to a prospective investor or financial backer when the model is adding its argument by actually operating.

A Temporary Socket

The installation and use of temporary electric decorations, no matter how cheaply accomplished, are generally costly on account of the short length of time they are used and because of material rendered unfit for further use.



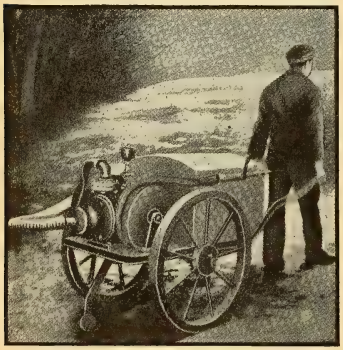
TEMPORARY SOCKET

Bryant sockets, as illustrated, having pointed set screws for connection to the circuit wires, will reduce this cost by saving the time used for splicing, taping,

etc., and making it possible to repeatedly use the same material. After the wires have been put in place, a few turns of a screwdriver, until the point of the screw punctures the insulation, completes the circuit.

Portable Pump for Fire Fighting and Irrigation

A pump direct connected to a motor and both mounted upon a two-wheeled truck is a convenience employed by German gardeners and owners of small



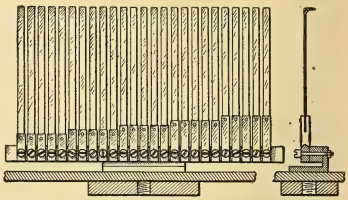
PORTABLE FIRE PUMP

farms. A reel for the hose and a holder for the nozzle are fixed upon the truck platform. The equipment, according to size, weighs from 450 to 800 pounds, and is light enough for one or two men to handle easily. It is also of service in fire fighting, being capable, if put to the test, of throwing 120 gallons of water per minute to a height of 90 feet.

Vibration Tachometer

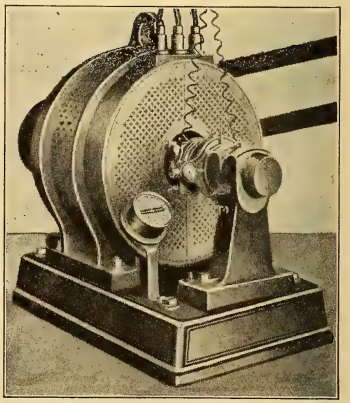
An interesting speed indicator or tachometer operated by the vibration of the machine to which it is attached is here illustrated. If a note is sung into a piano or played on another instrument, the corresponding string in the piano will vibrate sympathetically, and the same principle is followed in this instrument.

The Frahm vibration tachometer contains a number of steel springs or reeds mounted side by side as shown in Fig. 1. The reeds are made of high grade steel,



VIBRATION TACHOMETER

about .12 inch in width, and a small portion of the free end is bent at right angles and enameled white so as to be easily seen. The tachometer is affixed directly to the turbine or motor casing. The vibrations of the turbine cause the tachometer reed in resonance therewith to vibrate violently, so as to be distinguishable from the other reeds. For example, if the machine has one impulse or vibration for each revolution at 3,600 r. p. m., the particular reed would indicate which is adjusted for 3,600 vibrations per minute.



TACHOMETER IN PLACE ON MOTOR

Electrical Men of the Times

RAY PALMER

The lifting power of concentration, persistence and work are nowhere better exemplified than in that growing class of young men who are holding or reaching out for responsible positions.

Foremost among the former is Ray Palmer, appointed on March 19th of this year to the position of Chief Electrician of a city of two and one-half millions—Chicago.

Mr. Palmer was born in LaCrosse, Wisconsin, 34 years ago. His work at the University of Wisconsin was interrupted by active service in the Spanish-American war with the Third Wisconsin as sergeant of Company L, taking part in the skirmishes of Coamo and Abonida Pass in Porto Rico. He graduated from the University with the class of 1901.

His first position was with the J. G. White Company, New York City, as assistant superintendent in the installation of street lighting in Greater New York. The years 1902 to 1904 were spent in England for the same company.

Returning to this country, he was employed the following two years as electrical engineer for the old Union Traction Company in Chicago, now merged in the City Railway Company. Resigning this position in 1906, he started a consulting electrical engineer's business in Milwaukee and Chicago, which he continued up to the present appointment.

As a consulting engineer Mr. Palmer made a complete and valuable report on the water works system of Milwaukee in relation to its efficiency and the effect of electrolytic corrosion on the buried pipes. This was followed by a similar investigation of the underground metal work of Chicago, including, besides pipes of all kinds, bridges, the steel structure of buildings and all lead covered cables. In the matter of questions regarding electrolysis, Mr. Palmer is an authority. As a prominent engineer, referring to this, put it, "He eats it; just eats it."

At the present time an ordinance is pending before the Chicago City Council in conformation with Mr. Palmer's idea of the proper method of preventing electrolytic action on the underground metal work of the city and is causing a lively discussion, the principal feature being the estimated cost of preventive means.

Mr. Palmer is a member of the American Institute of Electrical Engineers, of the Western Society of Engineers, of the City Club and of the Kappa Sigma Fraternity.

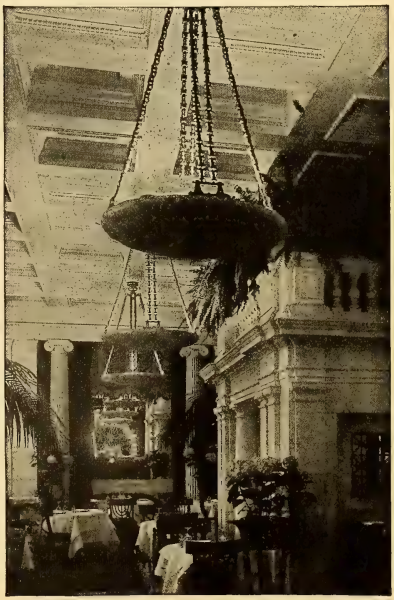
Electrical Interests of Women

EDITED BY GRACE T. HADLEY

Camellia Thea and the Modern Tea Room

The Camellia Thea is a plant that has exerted an ever increasing influence upon civilization during the past three centuries. It is a bushy shrub with beautiful white or rose colored slightly fragrant flowers, occurring either singly or in clusters. The constituents of tea are an essential oil, the caffeine or theine, producing the stimulating effect and the tannin giving astringency. Fragrance, flavor and aroma are the desirable qualities in tea. The rise in popularity of tea in England was rather slow up to the Nineteenth Century.

From the United Kingdom, which is the greatest consumer of tea, the custom of tea drinking has been rapidly growing in the chief cities of our own country. Tea rooms or places especially fitted up for the serving of afternoon tea are more and more a metropolitan feature. The environment of the "cup that cheers" is more artistic than ever known before. In many beautiful tea rooms of Chicago every afternoon one may see fashionable women taking tea. It is a great promoter of social life, and tea rooms now vie with each other in daintiness of service.



TEA ROOM IN BLACKSTONE HOTEL

On the sunrise side of the world in China and Assam, Camellia Thea develops its beautiful rose colored blooms and puts forth its fragrant buds and leaves. On this side of the world, the serving of the beverage made from the fragrant leaves demands more special tea rooms, more elaborate and expensive accessories. It has become an important afternoon social function.

Electricity

plays a most important part in the illumination of the modern tea room. Handsome electric floor standards are used and large silk shaded electric table lamps. Candles adorn the small tables with floral pink tinted shades that match the tints of Camellia Thea's blossoms. Yellow jonquils, tulips and the poet's narcissus assist in the scheme of decoration which includes subdued lights and harmonious blending of colors.

The tea table has gold decorated china plates. The tea tray contains a pot of fragrant tea, a pitcher of hot water, a jug of cream, a small dish with a slice of orange and clove bedecked lemon, while the tea biscuits or cakes are flanked with a little dish of salted almonds and candied orange peel. After a cup of tea, one dips the fingers into a bowl of water in which float perfume buds, and then one is ready for the music of the afternoon.

"I am deeply interested in the subject of electricity," said Miss Gleason, manager of one of the large tea rooms in Chicago, "and I think electric cooking is full of possibilities. When we remodel the kitchens of our tea rooms I hope the cooking may all be done on electric ranges and with electric utensils. It may be a trifle more expensive, but there is a compensating saving of labor. Then electricity is so safe and sanitary; in fact, there are so many advantages in favor of electric cooking that I can scarcely enumerate them all."

The tea room in the Blackstone Hotel, Chicago, as an example, is one of the most beautifully illuminated interiors in the world. It is an exquisite Grecian marble café. The ceiling is paneled and finished in ivory white. The fixtures consist of shallow bowls suspended by bronze chains. Each bowl contains 20 indirect lighting units, consisting of 60 watt tungsten lamps, with clear bulbs and reflectors. The bowls are hung four feet from the ceiling, there being six of them in the room. It is generally conceded by architects that pure classical architecture furnishes one of the most difficult of all problems to handle with respect to artificial lighting. The methods used in ancient Greece were so absolutely inadequate and unadaptable to modern conditions as to render them out of the question. The only alternative is an adaptation of Twentieth Century lighting units to an architecture 20 centuries old. The indirect method of illumination possesses the unquestioned advantage, while the general diffusion of the light after the manner of daylight brings out the architectural features in their proper perspective and relations.

Thermal Storage Electrical Stove

An electrical stove has been recently designed to consume electrical energy continuously at a low rate throughout the full 24-hour day and give off energy as needed quickly for cooking purposes. The energy is stored in a mass of cast iron thermally insulated from external influences by means of lampblack or powdered silica and thermally in direct contact with the cooking utensil. The cast iron mass for storing the heat is mechanically connected to a hydraulic plunger so that it may be raised at will to expose its upper surface for cooking purposes or lowered when it is desired to retain the heat. A central station can contract to furnish energy to the device without the use of a meter, the contract being on a flat rate.

Household Ozonator

The household ozonator has been designed to meet the various conditions found in residences and is ideal in detail for household use. A two-point switch provides an excellent means for controlling the quantity. In the bedroom, for instance, the device would be operated on low output, while, on the other hand, in the kitchen, where there are strong odors from cooking, the maximum output would be used for, at least, brief periods.

I was born in the Land of Sunrise centuries ago. Some say the idea of a fan originated in the palmetto leaf borne to and fro by the breeze, but the Chinese who claim to have invented me, trace my origin into the land of legends. Langsin, the daughter of an all powerful mandarin, was present at a Feast of Lanterns. Overcome with the heat, she removed her mask—a daring thing to do. She still held it near enough to screen her features, while waving it to and fro. It is said that to this caprice of a princess, the origin of a fan is due.

I Was Born in the Land of Sunrise Centuries Ago

In the beginning I was a trifle, a mere trifle, an airy thing made of bamboo, a bit of paper or silk adorned with a lily bud or a leaf. Sometimes a flight of swallows, a handful of graceful grass or a dragon fly appeared upon the paper surface. Later I was evolved more elaborately from ivory, dragon skin or oiled silk and finished with a silken cord and tassel. Little figures were sometimes wrought in silk embroidery, for silk was an ancient and highly valued material. In China I was a flat, stiff, hand screen, but finally the Japanese improved me by making me an ogi or folding fan. I then acquired a framework of sticks of the same length and thickness, with the outer stick wider and heavier. For the Japanese I soon became an emblem of life. The rivet end was the starting point, and as the rays expand, so the road of life was supposed to widen to a prosperous future, therefore I was used as a gift on important occasions. In the oriental lands I was always an indispensable weapon against the hot climate and swarms of insects, and it was not long before I became another kind of a weapon, a war fan. The Japanese sewed two thicknesses of leather together and attached an iron handle over a foot long, very strong and heavy, thus making a formidable weapon. Gold was used for the rivets of war fans, also for ornamentation, while

Then I Became a Professional Breeze Maker

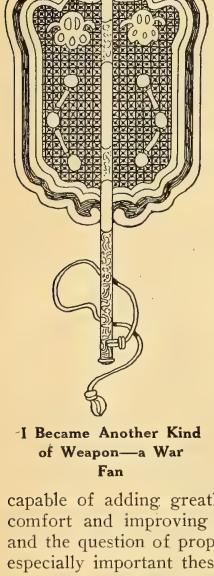
bronze embellished the metal handle.

In Egypt I was a royal emblem and signified authority, happiness and repose. The worshipful company of fan-bearers were generally persons of royal birth. Imagine with what elaborate ceremonies they escorted the stately Cleopatra, waving the semi-circular screen fan attached to a long handle. In Greece, I was made of peacock feathers, as the peacock was Juno's bird and symbolized luxury and splendor. I enhanced the great festivals of the Romans, for slaves stood behind the guests and waved fans made of peacock feathers enriched with ostrich plumes.

The Japanese Improved Me

Early in the Eighteenth Century I reached England, where I became a mere feminine accessory, but I was held in high favor and carried at court. Then I finally crossed the Atlantic and came to America. Here I settled down and developed from a mere caprice into a commercial necessity. I became more substantial in every way. The bamboo, silken paper and plumes disappeared entirely. I was made with a motor body and base finished with black enamel, with fan blades, guards and trimming in dipped and lacquered brass. My silken tassel became an attaching cord and plug and I was connected with an electric current. Then I became a professional breeze maker with a range of operation. I am useful in the home in a variety of ways. Fresh air is one of the most important factors of modern healthy living, and I freshen the air and ventilate the home. In the library, dining room and bedrooms, I am indispensable. I never get tired or fall asleep like the

punkah boys in India. The higher the mercury climbs the busier I am, for I can keep a home comfortable on days that would otherwise be unbearable. For a small cost I provide hours of cooling breeze. I am very popular in an eight-inch size where only a moderate breeze is required, and I am made both with and without an oscillatting mechanism. Recently some of my relatives have acquired two sets of blades revolving in a circle and with three running speeds. The baby six-inch fan is a favorite. Try it and be comfortable. In stores, hotels, offices, restaurants, cafés and residences, I am capable of adding greatly to individual comfort and improving the ventilation, and the question of proper ventilation is especially important these days.



I Became Another Kind of Weapon—a War Fan

Fan Facts

Air should be changed in public buildings to insure health and comfort—in large public rooms every 20 minutes—in shops, offices, halls and churches every 20 minutes. The electric fan offers a simple solution of all difficulties in the way of ventilation. It can be fixed in any position and controlled from a convenient point. It is silent and its simplicity of construction is such that it seldom gets out of order; moreover, it does its work at an extremely low cost and it can be switched on or off with the greatest ease and facility.

The electric fan must not be overlooked, for it has proved itself invaluable, with its cooling breezes in summer and its power of distributing warm air in winter, or exhausting the foul air from the room.

Exhaust fans are now extensively used in factories, public buildings and offices, also in hotels and restaurants; in fact, by all who wish to attract customers. Proprietors of such establishments realize that pure air is desirable for the comfort of patrons as well as necessary to good health.

The initial cost of an electric exhaust fan is lower than that of any other apparatus capable of moving an equal amount of air.

Oscillating fans are suitable for use in large rooms or in places where a breeze blowing steadily in one direction is not desired. In operation the fan swings slowly from side to side, so that the air current sweeps over a wide area.

The housekeeper who formerly got along with one fan now has several. She is not satisfied only to have the fan breeze to sit by when she reads or works, but requires it for the bedrooms and for the kitchen as well.

Eight-inch fans give a moderate breeze. They are light in weight, strong in construction, attractive in appearance and practically noiseless in their operation.

The Swinging Electric Breeze

Why sigh for the breeze
  That wavering blows
Thro' the trees and leafy glades?
We'll give you the breeze
  That steadily flows
From the thrust of whirling blades.

Pay dear if you will,
  And seek where you can
For breeze worth a princess' dower;
We'll give you your fill
  From a 'lectric fan
At less than a cent an hour.

A Home-Made Electric Lamp

Here is a home-made electric lamp. It is a modern, artistic electric lamp with a Princess shade and it is made out of an old oil lamp. Mrs. T., a Chicago lady, has achieved this feat of doing something that all her friends said could

HOME-MADE ELECTRIC LAMP

not be done, and they marveled that she dare attempt it. She confesses that she surprised herself, not to mention the family and a host of friends, who are making special calls to see the home-made electric lamp.

For some time the good brass standard of an old oil lamp stood about on a closet shelf. Every time she saw it, she thought it ought to be used and finally she ordered a wire frame to be made, which cost $2.25. Then came the problem of covering the frame, and all her women friends assured her that this was a most difficult bit of work and that she better not try to do it. Being a lady of resources and some skill in trimming, she decided to make an attempt to trim the wire frame.

At a large department store she purchased two bolts of rose silk binding tape to cover the wire, one yard of embroidered rose silk for the outside, and two-thirds of a yard of China silk of a lighter shade, three and a quarter yards of gold braid, and 50 inches of gold fringe. The cost of the material, including frame, came to about nine dollars. Then she worked for two days, covering the frame first with binding tape, then putting on the outer silken cover, then sewing on the gold braid and fringe, and last, but not least, putting in the lining. This was a ticklish job and demanded a good deal of ingenuity. The shade is 33 inches in circumference at the top and 50 inches at the bottom. When completed, the combination of the old brass standard with the new Princess shade was so pleasing, Mrs. T. decided to ascertain about how much such a shade would cost if purchased regularly in a store. She was amazed to find that she could not buy anything approximating her shade in appearance for less than fifty dollars.

An artistic electric lamp in a library really constitutes the center of family life in the evening. Equipped with a tungsten lamp, a beautiful Princess shade of rose silk, it becomes the final word in a scheme of home-like house furnishing, where the keynote is harmony.

A Cent's Worth of Electricity

A cent's worth of electricity at ten cents per kilowatt-hour will bring to a boil two quarts of water; run an electric broiler for six minutes; operate a twelve inch fan for two hours; will make a Welsh rarebit in an electric chafing dish; operate a sewing machine motor for three hours; will keep a four inch disk stove hot for fifteen minutes; will make four cups of coffee in an electric coffee percolator; will keep a six-pound electric flat-iron hot for fifteen minutes; will heat an electric curling iron once a day for two weeks.

Don't Neglect the Vacuum Cleaner Bag

A man who did not want a vacuum cleaner finally permitted a $125 machine to be installed in his home on trial. When it was called for by the salesman he was asked to let it remain in the house another day or so.

"I may decide to keep it," explained the gentleman.

Some time after this the salesman was worried with repeated calls to come out immediately, the vacuum cleaner was out of order; it would not work at all! The salesman was very busy and could not leave the office that day.

"Say," he remarked, "you have lived over 20 years without a vacuum cleaner and I think you can live through one more day. I can't come out until tomorrow."

The following day the salesman went out to investigate the cause of trouble. Removing the top, he discovered that the bag was packed full of dirt in a solid cake. The vacuum cleaner had been used continuously for two weeks and the bag had never been emptied once!

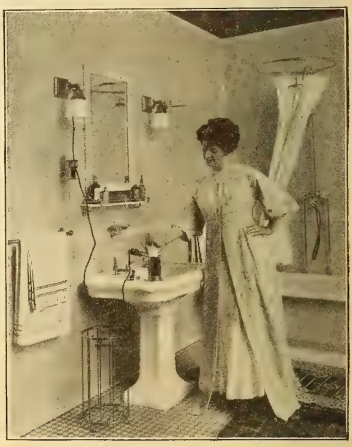
Mechanical Refrigeration

Perfect refrigeration means pure, wholesome food. The utilization of automatic electric refrigeration insures perfect refrigeration. Some of the advantages of such refrigeration are that it is cleanly, dry, sanitary and economical. It can be regulated so that the same temperature will be maintained in the refrigerating chamber whatever the temperature may be outside. Temperature obtained by melting ice is always variable. Automatic electric refrigeration keeps the ice box cold all the time with no drip pan or drain pipes to think about. No more tainted meat, no spoiled milk and the ice man is no more for the user of perfect refrigeration with electricity.

The Auto-electric refrigerating machine is especially well adapted for meat markets, groceries, restaurants, hotels, buffets and apartment houses. It is reliable and requires no engineer. The convenience of the automatic feature is one of the principal advantages of this type of refrigeration. You merely install the machine, connect it up, set the thermostat at the desired degree of temperature, and then it does the rest. Your worry is over. A small automatic electric machine is also made for use in private homes.

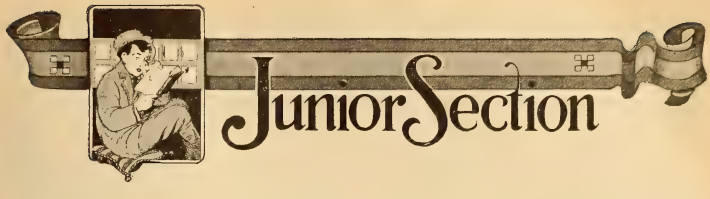
Electricity Adds to Baby's Comfort

An electric device especially designed for heating baby's bottle will be appreciated by mothers who have small children to look after. A convenient method of heating the milk quickly has long been wanted and the device shown in the accompanying photograph seems to meet all requirements.



A CONVENIENT METHOD OF HEATING MILK

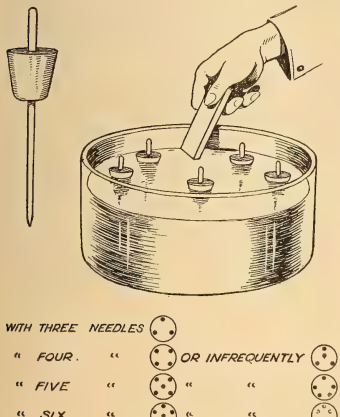
The metal container is just large enough to hold the nursing bottle and when the current is turned on will bring the liquid to the proper temperature in a few minutes. It is so small that it may be carried in a suit case or transferred from room to room.



An Interesting Experiment in Magnetism

A simple experiment which can be performed by any one will go far toward explaining, in a graphic way, something of the nature of molecular arrangement and action.

A small supply of ordinary sewing needles, preferably of the size referred



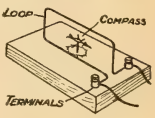
EXPERIMENT IN MAGNETISM

to as No. 6, should be magnetized so that all the points are north. Each needle should then be driven into a cork so that the eye appears just above the top of the float. The corks are then mutually repellant, and if dropped into a basin of water will attempt to get as far away from each other as possible. If the north pole of a large bar magnet be now lowered over them they will arrange themselves in geometrical figures, varying in design according to the number of corks used, as shown in the diagram.

Diagrams may be worked out for as many needles as the basin will hold, and it will be found that they will adhere to the regular arrangement except occasionally when they seem to prefer for the time being some other form, as shown in the second column of the diagram.

A Simple Ammeter

Experimenters with small motors, batteries, etc., are often at a loss to find out how much current they are using. The following apparatus will serve and give approximate results:



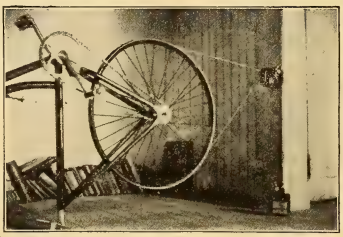
A small piece of hard wood 1 by 6 by 8 inches is used for a base, on which is fastened a loop of No. 6 copper wire, bent as shown, and having about two inches clearance between the top and bottom wire. A short compass needle pivoted on a needle point is free to swing over a degree scale. With the compass needle in place nearly between the wires, turn the instrument until the wire is parallel with the needle and mark this point zero on the circular scale. Current through the wire will deflect the needle. Sixteen candlepower carbon lamps which require one-half an ampere each may be used to calibrate up to 1½ amperes.—H. G. Wilson.

ONE OF THE NOBILITY AND HIS ELECTRIC AUTO

This picture was sent to us from Warwick Castle, England, through the courtesy of the Countess of Warwick, and is a photograph taken nine years ago of her son in his little electric car. He was then five years old. This miniature car illustrates the perfection which even then attended the construction of electrics. The motor is one-half horsepower and the top speed of the car is four miles an hour.

How Electricity Is Helping Me Through College

The accompanying picture illustrates one way I employ to make money to go to college. The bicycle is screwed to the floor. It is connected by a heavy cord to a small eight volt direct current dynamo which has sufficient capacity to charge small storage batteries. People of means who live around me pay me to charge their storage batteries and keep them in good order. They use them to run fans, ring bells, for electric miniature lights and for automobile ignition.—J. W. Quimby.



UNIQUE BATTERY CHARGING OUTFIT

A Model Power Plant

The accompanying picture shows a model power plant built by Henry Walter, a student at the Allentown Preparatory School, Allentown, Pa. The model represents a small 500 volt direct current station of the type operating a railway system.

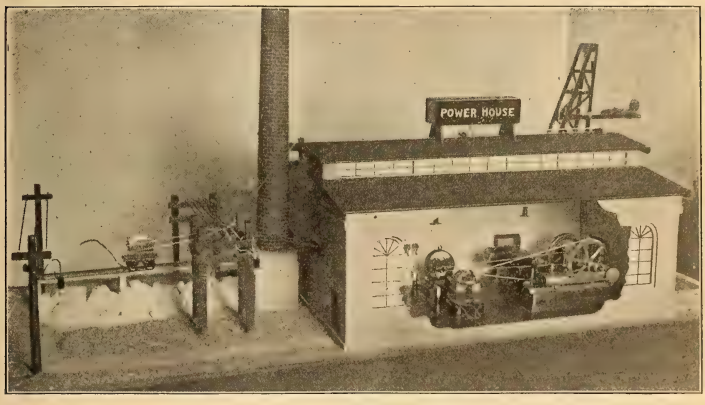
There are two generating units and a small exciter engine not shown. The dynamos are really motors, but the effect is that the engines are furnishing the power.

To the left of the dynamos are seen the equalizer and main switch stands. Only one panel of the switchboard is shown. The circuit-breakers, meters, and all the appliances of this switchboard were carved from wood.

From the ceiling are suspended two arc lamps which light the interior. There are also three arc lamps in the yard and one on the coal hoist. From the roof the words "Power House" flash forth in letters of red and green.

In the background is seen the little ash car. This car appears from behind the stack, runs to the end of its trestle, dumps, and returns, the operation being kept up as long as the current is on.

At the extreme right is shown the coal hoist. The bucket rises from the hold of a canal boat to the carriage of the hoist, runs in over the chute, then out again and down. Both the motion of the ash car and the coal hoist are automatic and continue as long as the current is supplied.



A MODEL POWER PLANT

Electricity in Flames

If two copper wires are placed in a yellow, sooty flame, such as a gas burner or a candle, one above the other, say two and a half inches apart, an interesting discovery can be made.

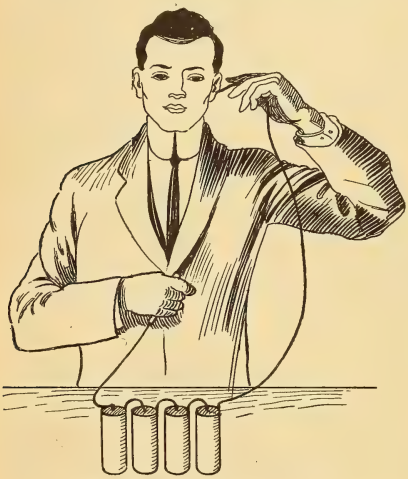
Both, of course, become black with carbon. If then they are joined to a battery of six or eight good cells in series, the black carbon or soot will change into a sort of tree or growth with a kind of trunk from which fine branches extend into the flame, as soon as the potential difference exceeds twelve volts. It is of no use whatever to raise the voltage above 25, for the beautiful phenomena are not increased or in any way augmented; nor do they become any more pronounced in excessively sooty flames. The soot must be very fine and soft, like that of a candle.

Electric Stimulation of the Senses

As long ago as the year 1830 it was known that the senses could be stimulated by means of electricity. It was found that by applying the terminals of a battery to the tongue, nose, lips, ears, etc., various sensations were experienced, although the same sensation was not always felt when the terminals were reversed.

Electric vision has been produced by placing tinfoil over the eyelid and connecting it to a silver plate held in the mouth. A bright flash before the closed eye was noticed on closing the circuit even without a battery in series. A dry cell can be used in the circuit without danger. Then the plate in the mouth need not be silver.

Helmholtz used twelve small cells in series with two paper covered electrodes which were soaked in salt water. One electrode was pressed against the brow while the other was held in the hand. He describes the effect as a whitish violet tone in the eye. On opening the circuit a flash was seen. Various observers note different effects. Numerous color effects are obtained by passing the current from the temple to the bridge of the nose or transversely across the eye. Electric stimulation also changes the appearance of colors when viewed while current is passing transversely through the eye, as in the last method described.



STIMULATING HEARING

ELECTRIC VISION

Recently sensations of light have been produced by placing the head in a changing magnetic field. A coil of wire is wound large enough to admit the head, and when an alternating voltage is impressed upon it currents are induced in the optic nerve, due to the alternating magnetic field.

Electric hearing is produced by placing the terminals of a battery of several cells

in contact with the external auditory passages, the latter having first been filled with tepid water. When the two wires were placed on the lobe of one ear or, respectively, on the ear and in the moist hand, the note "g" was heard. In many cases it is not heard.

Electric taste is produced by holding in the hand the negative wire of a battery of several cells and placing the positive wire on the tongue. A decidedly acid taste is experienced. When the connections are reversed the taste has been described as bitter, harsh, caustic, and alkaline, while others find it merely acid. It is possible that electrolysis of the saliva results and hence the acid taste; however, the acid thus set free would be neutralized by the alkaline saliva, and besides no acid has been found present. The same effect is produced when a piece of cooked meat is interposed between the tongue and the wire.

If two persons touch tongues together while each holds a terminal of a battery the one holding the positive wire tastes acid while the other tastes alkaline. This experiment was reported years ago.

Various sensations of feeling can be obtained depending on the method of applying the electric stimulus. Among the sensations described are cold, heat, cutting and burning.

Experiments on electric smell are not as satisfactory as those on the other senses. It is claimed by one experimenter that a putrid odor was experienced when the terminals of a battery were placed, respectively, on the nose and in the mouth, or on different parts of the nose.

The fact that the senses can be stimulated by means of electricity is not astonishing when it is remembered that electric currents are supposed to carry all messages to the brain.

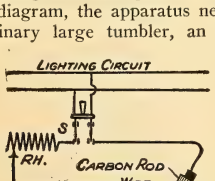
ELECTRIC TASTE

HELMHOLTZ'S EXPERIMENT

Smoke is no longer the sign of a busy manufacturing community. At the present rate of electrical development it will be but a comparatively few years until the factory from which clouds of smoke belch forth will be the exception.

Formation of Imitation Crystals

A very interesting experiment in making imitation crystals can be performed by following directions given: As shown in the diagram, the apparatus needed is an ordinary large tumbler, an electric



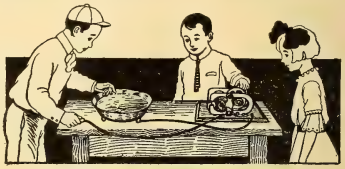
APPARATUS FOR FORMING IMITATION CRYSTALS

light carbon, small pieces of colored glass about the size of the bottom of the tumbler and a piece of bare copper wire No. 14, connected up as in the diagram. Wires from the lighting circuit are led to a small switch and then through a water rheostat (RH) to the two electrodes, consisting of the carbon rod and the copper wire.

The tumbler is nearly filled with water and a little salt added to make the solution more conductive to the current. On the bottom of the tumbler place one of the pieces of colored glass. Some friction tape or cloth should be wrapped on the upper end of the carbon rod so that it may be held in the hand. The rod and the wire are held about an inch from the bottom of the tumbler and touched together for a second. Upon drawing them apart a small distance there will be an arc formed between the carbon rod and the copper wire. This is all done under the water, as the arc can be seen through the sides of the tumbler and gives out a very brilliant green color. The arc is kept going until a small ball of hot copper formed on the end of the wire falls off. As the ball of copper touches the glass plate, the glass is heated and a small piece cracks off. As the copper cools, it clinches the small glass particle. This imbeds the colored glass in the copper and the whole looks as if a jewel were imbedded in a large shot. The different crystals can be made in the same way by using different colored glass.

Shocking Money

A dime or a quarter in the bottom of a dish of water may look like very "easy" money and is under ordinary conditions. However, with the arrangement shown in the illustration, the ease with which the coin can be picked up depends upon how much of an electric shock one can stand.



FUN WITH THE SHOCKING MACHINE

An ordinary magneto with one terminal connected to the basin, if of metal, and the other terminal held in the hand, will impart a nice little surprise to the finger tips.

How to Remember Which Is the Cathode

A good many times I have had occasion to use the words "cathode" and "anode" in my school work in physics and chemistry. I always found it rather confusing to remember which was which, until one of our professors helped me by telling how he always remembered.

He said that when he was a boy at home, they had a big cat that could open the screen door and *go out* but could not *enter* by the same door.

He always related the cat and the house, respectively, to a current of electricity and the cell or battery from which it comes. He thought of the screen door as the "cathole" where the cat went out of the house, as similar to the "cathode," where the current went out of the battery.—ALDEN GILPEN.

Advice to Prospective Wireless Operators

By JAMES M. MERCER

With the enormously rapid development of wireless telegraphy, it has been but natural that many young men should have entered this field, but in many cases without seriously considering its opportunities. A brief discussion of the advantages and disadvantages of this work, remuneration, etc., may not be amiss.

We will divide this discussion into several geographical sections, as each presents some local characteristic.

THE GREAT LAKES

The work done in this region is of a mediocre class and cannot be justly taken as a basis of comparison. Salaries are low, averaging about $35.00 per month for steamship operators, and at times very uncertain. Furthermore the operators generally are not accorded the treatment which, in view of the importance of their position aboard ship, they should have. It has been found necessary on some steamship lines to have the operator's meals served in the same mess-room with the stewards and waiters, which is of itself rather unpleasant.

The majority of steamers make short night trips, thus imposing night duty on the operator. However, this has the advantage of allowing shore leave during the part of the day not spent in sleep, which would not be feasible otherwise.

The salaries of land station operators are higher, of course, but living expenses must be taken into consideration, which is not the case aboard ship. Operators are paid on a scale based upon the amount of work done at their station, number of hours at work, day or night trick, personal ability, etc., usually from $55.00 to $70.00 per month. This work is generally entrusted to men with one or more seasons of meritorious service behind them, and is rarely given to novices.

In discussing the Great Lakes, no small consideration must be given to the fact that there are only about 8½ months of work during the season of navigation, the majority of the stations closing for the remainder of the year.

However, some men thus thrown out of employment are taken care of by the coast companies.

THE PACIFIC COAST

This section offers a limited field of employment at a fair salary. There are coast stations from Los Angeles to Seattle and several commercial stations in Alaska. Coastwise steamers ply both north and south from San Francisco and there is passenger mail service north to Alaska and south to the tropics. All these steamers are equipped with wireless apparatus. Probably the most desirable of all positions here are on the large palatial liners to the Hawaiian Islands and the Orient.

There is a good deal of work done, providing employment for quite a few operators and construction electricians and also special workmen, at a large commercial laboratory at Seattle. But this demand is amply cared for by the supply of men directly in that district, and the East or Middle West are rarely drawn upon.

THE ATLANTIC COAST

We have here four large companies doing a big business and one or two smaller ones.

Nearly every steamer entering or leaving New York carries her wireless antenna, and a good operator should experience small difficulty in securing a berth.

A United States government license is necessary for work here and in the case of steamers touching foreign ports foreign licenses are often required. These should, however, offer but little difficulty to the man who understands his business.

The average operator going to New York will no doubt secure his first position on some coastwise steamer equipped with United Wireless apparatus. This would be a good place to gain much valuable practical knowledge and should be taken advantage of before aiming higher.

The Marconi company usually wants men experienced in the use of both codes and with a successful past record. The large proportion of its operators come directly from its own training school in Great Britain.

The Marconi company of America, however, will employ operators not of its own training.

Both the Fessenden and Telefunken companies use a highly perfected type of high frequency apparatus, requiring exceptionally skilled operation. Both companies do a large amount of government contract work and only the best of men should apply to these firms for work.

The salaries on the coast vary greatly, ranging from the four pounds sterling ($20.00), paid by the Marconi company on some of its boats, to what is probably the most sought-for steamship position on the coast, a berth aboard one of the fine steamers of the United Fruit Line, paying $65.00 to $80.00 per month and expenses. These boats are equipped with Fessenden apparatus.

The land stations of the United Fruit Company's service pay up to $150.00 per month for a chief operator, other operators being paid according to their work.

The salaries for land station work for other companies on the Atlantic coast rarely exceed $75.00 per month. This practically exhausts the commercial field of this country.

A brief word now of other opportunities.

GOVERNMENT SERVICE

The only positions open to civilians come under the classified civil service laws and applicants must enter a competitive examination in which the following are made the basis of grades:

Practical experience	50%
Practical questions	20%
Spelling, penmanship, etc	30%
Total	100%

It is readily apparent from this, that unless one has a long successful record he may as well spare himself the trouble of taking this examination. These positions are usually in either the Hawaiian or Philippine Islands and pay $75.00 to $90.00 per month, generally, with quarters allowed.

Incumbents are open to advancement to the position of wireless inspector at a higher salary.

At the present time there are no government stations in the United States proper, that come under this classification, that are not directly controlled by the Naval Service and manned by bluejacket electricians.

Full information regarding the Naval Service can be obtained by applying to the Navy Department, Washington, D. C. Suffice it to say that electricians, after having reached the first class grade, are eligible for examination to the rank of Acting Chief Electrician, subject to a permanent appointment as such, and at a rate of pay of $66.00 and $77.00 per month respectively.

There is one other government service open.

THE U. S. REVENUE CUTTER SERVICE

A limited number of good positions are available in this department. Applicants must show a good record or pass an examination and are then subject to appointment as vacancies occur. Appointment is made to either of two grades—Second Class Electrician at $44.00 per month or First Class Electrician at $66.00 per month—both grades having a commuted ration allowance. Appointees are stationed aboard one of the revenue cutters. Further information can be had on application to Secretary of Treasury, Washington, D C.

IN GENERAL

Wireless work is intensely interesting and, judged from that standpoint, looks very attractive. Leaving out of consideration land station work, which is more or less routine, we might look into the life of a wireless officer aboard ship.

Primarily a good wireless man must be able to endure the strain of long continuous duty if the occasion arises necessitating it. Ordinarily a few hours in the morning, similarly in the afternoon and most of the evening are the hours spent at the key. This of course varies with any prearranged schedule. The work entails the ordinary hazards of the sea and in the event of disaster the operator must remain at his key, in spite of anything that happens, flashing out his S. O. S. call, and continuing to do so until help is brought or the dynamo fails to furnish the necessary current.

Separation from home and friends is another item. On the other hand the wireless man in the course of his career sees many strange ports and foreign peoples, makes hosts of acquaintances and leads a rather care-free existence.

PREPARATION

After due consideration of the foregoing, if a young man decides to enter this work he is confronted by the difficult problem of adequate preparation. Alluring advertisements of wireless schools are in every magazine. This, then, seems to be the only practical solution of the question: *Investigate a school thoroughly* before entering it, as your work there will bear upon your whole future.

Briefly, the essential qualifications for a good wireless school are:

(1) Instructors to be experienced practical men.

(2) Maintain a complete practical station of commercial design.

(3) Individual instruction as much as possible.

(4) Teaches both Morse and Continental codes.

Some schools assert that the Continental code is unnecessary, and that it is a waste of time to learn it. The writer, to the best of his knowledge, knows of no place in the world, with the exception of the Great Lakes of America, where the Continental telegraphy code is not used, and in many places exclusively. In fact, the Morse code is distinctly American.

One other method is open to the embryo wireless operator. Learn the codes by means of buzzer and key and then apply to the nearest wireless office for a position as messenger. By paying close attention in spare moments, the practical operation can be learned.

Eclipse of Sun Affects Wireless Transmission

During the recent solar eclipse an interesting test was undertaken between the radio station of the Royal Dock Yard in Copenhagen and the Blaavandshuk station on the coast of Jutland, so as to ascertain the effect of the eclipse upon wireless transmission. It transpired that the telegraphing became more distinct and reliable as the eclipse progressed, and that it was most distinct shortly after the culmination of the eclipse. The view that it is the effect of the solar light upon the atmosphere which is the cause of radio-telegraphy being much better at night than during the day seems thus to be confirmed.

English Boy Scouts Studying Wireless

Some of the Boy Scout troops of England are giving considerable attention to the studying and using of practical field wireless telegraphy.

EXPERIMENTING WITH WIRELESS APPARATUS

The Second Royal Eltham Troop, whose ages range from eight to seventeen years, have equipped themselves with a complete portable wireless telegraph outfit, for both sending and receiving. Under the direction of their scoutmaster they are mastering the intricacies of the Continental and Morse codes, and many of them are already making good progress. At their camp they use a portable, light, iron table, while the field workers who go out a distance of from two to five miles pack the apparatus on their backs. The field workers when out on march do not carry a table, using one of the outfit boxes for a sending table and the other for a seat. Tall bamboo poles are used to hoist the aerials.

The development of wireless telegraphy during the last three years is remarkable. In January, 1909, there were 92 wireless stations in action and 416 ships provided with wireless apparatus. In January, 1910, there were 136 land stations and 619 ships provided; in January, 1911, there were 219 land stations and 988 ships fitted with wireless apparatus.

Questions and Answers in Wireless

By A. B. COLE

(DETECTORS—CONCLUDED)

62.—*Explain a theory regarding the operation of imperfect contact detectors.*

In all these detectors the two or more active materials are in very light contact. The line of distinction between rectifying and imperfect contact detectors is not well defined. One form of the latter type consists of two carbon blocks sharpened to fine edges, which support a steel needle. This combination constitutes a microphone, and is very unstable. The slightest jar throws this detector out of adjustment. The resistance of this detector is very high, and but little current from the local battery passes through it. The high tension oscillations from the aerial are sufficient to break down this resistance and to carry the battery current through. At their cessation the resistance of the detector again becomes high and consequently the flow of battery current through it is diminished.

Another form of imperfect contact detector is the coherer, which was most fully perfected by Marconi. This was composed of a glass tube of a diameter of about $\frac{1}{8}$ inch, containing about $\frac{1}{16}$ inch of filings composed of ten per cent silver and 90 per cent nickel. One of two silver plated metal plugs which fitted the tube exactly was arranged so that it could be moved into or withdrawn from the tube, thereby exerting a greater or less pressure on the filings. The other plug was stationary. In the better coherers the air was exhausted from the tubes.

In using the coherer it was necessary to employ a mechanical device, called a decoherer, to restore the high resistance of the filings at the cessation of the waves. The coherer was used in connection with a telegraph relay and sounder. It was unreliable, but was the first practical detector of electromagnetic waves as applied to wireless telegraphy. One of the most important applications of the coherer today is for demonstration purposes, where an audible signal is desired.

A form of imperfect contact detector was invented by Solari, and is sometimes called an autocoherer. This is composed of two carbon rods inserted in a glass tube and having between them a small drop of mercury. A local battery in connection with a potentiometer is used with this detector.

A fourth form of imperfect contact detector is known as the Lodge coherer, and consists of a metal wheel which is revolved so that its periphery touches the surface of a body of mercury which is covered with a layer of oil. The high tension oscillations break down the resistance between the wheel and the mercury, which is restored by the revolution of the wheel.

63.—*Explain the tantalum detector.*

This detector consists of a cup containing mercury and a fine tantalum wire held in such a way that it may be raised or lowered into the mercury. The tantalum wire may be obtained from a tantalum lamp. This detector requires a local battery, which is connected in the same way as with an electrolytic detector. The tantalum detector reproduces strong signals loudly, but is not as sensitive as some of the crystal detectors.

64.—*Name the crystal detectors in rank of sensitiveness, assuming that the crystals used are all of the best quality.*

Ferron; perikon; carborundum; silicon; molybdenite.

65.—*Is the perikon more sensitive than the electrolytic?*

The perikon detector is considered to be about ten per cent more sensitive than

the electrolytic described in answer to question 61.

66.—*State the composition of a fusible metal suitable for holding crystals in metal cups.*

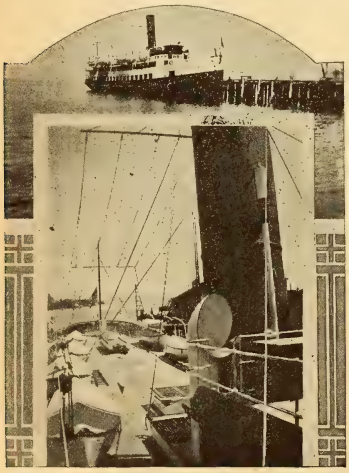
A material for this purpose should have a low melting point, since the use of solder or other compounds of comparatively high melting point is liable to decrease the sensitiveness of some of the crystals on account of the heat to which they are subjected when being fastened in the cups. One of the best alloys consists of the following:

Bismuth, 50 per cent; lead, 25 per cent; tin, 12½ per cent; cadmium, 12½ per cent.

This is known as Wood's Metal and melts at 149° F.

Novel Method of Suspending Aerial

It was found necessary to remove the masts of the steamer "Cabrillo," of San Pedro, Cal., for shortening and general overhauling, while the requirements of travel were such that it was necessary for the steamer to make its daily trip from San Pedro to Avalon, Catalina Island, thus necessitating the use of its wireless outfit. Accordingly, the plan illustrated was adopted.

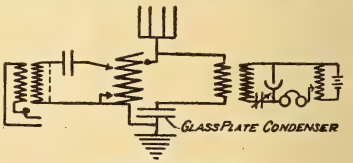


NOVEL AERIAL SUSPENSION

In order to support the aerial a small mast was placed in the stern of the boat on the upper deck and a pulley was made fast to the upper end of the smokestack. The aerial was suspended between them, thus raising it about 30 feet above the instruments. No difficulty was experienced in maintaining communication with this temporary installation.

"Break-in" System

The accompanying diagram shows a simple "break-in" system. The condenser is of the plate glass type. I have found a carborundum or any detector that is not affected by strong transmitting to be very satisfactory.—Geo. Uzmann.



BREAK-IN SYSTEM

Wireless in Chicago Schools

With the approval of Mrs. Ella Flagg Young, superintendent of Chicago schools, the school management committee has adopted a recommendation urging the teaching of wireless telegraphy in the public schools.

The Titanic disaster, it is said, has caused hundreds of boys in the city high schools to petition for instruction in wireless telegraphy.

The north coast and the interior of Honduras will be soon connected by wireless telegraphy. Wireless is of special value in the tropics, where line transmission is extremely difficult owing to the rank vegetation and dense forests.

Directory of Wireless Clubs

This directory of amateur wireless clubs and associations will be published each month. When a new club is formed the names of the officers, also the street address of the secretary, should be forwarded to us at once. Any changes that should be made in the directory, when designated by an official of a club, will be made in the next issue after receipt of such advice.

Aerogram Club.—J. Stedman, President; A. Hayward Carr, Chairman Board of Directors; Albert S. Hayward, Treasurer; Donald P. Thurston, Secretary; Walter B. Clarke, 17 May St., Newport, R. I., Corresponding Secretary.

Aerograph Club of Richmond, Ind.—H. J. Trueblood, President; Richard Gatzek, Vice President; James Pardieck, 320 South 8th St., Richmond, Ind., Secretary.

Aero Wireless Club.—A. Garland, President; W. Ladley, Vice President; D. Beard, Napa, Calif., Secretary and treasurer.

Allegheny County (Pa.) Wireless Association.—Arthur O. Davis, President; Theodore D. Richards, Vice President; James Seaman, Leetsdale, Pa., Secretary and Treasurer.

Alpha Wireless Association.—L. L. Martin, President; F. A. Schaeffer, Vice President; G. F. Girton, Box 57, Valparaiso, Ind., Secretary and Treasurer.

Amateur Wireless Association of Schenectady, N. Y.—D. F. Crawford, President; L. Beebe, Vice President; C. Wright, Treasurer; L. S. Uphoff, 122 Ave. "B," Schenectady, N. Y., Secretary.

Amateur Wireless Club of Geneva (N. Y.).—H. B. Graves, Jr., President; C. Hartman, Vice President; L. Reid, Treasurer; Benj. Merry, 148 William St., Geneva, N. Y., Secretary.

Berkshire Wireless Club.—Warren A. Ford, President; William Yarkee, Vice President; Charles Hodecker, Treasurer; Jas. H. Ferguson, 18 Dean St., Adams, Mass., Secretary.

Canadian Central Wireless Club.—Alexander Polson, President; Stuart Scorer, Vice President; Benj. Lazarus, P. O. Box 1115, Winnipeg, Manitoba, Can., Secretary and Treasurer.

Cardinal Wireless Club.—K. Walthers, President; F. Dannenfelser, Vice President; Miss A. Petersen, South Division High School, Milwaukee, Wis., Secretary.

Chicago Wireless Association.—John Walters, Jr., President; E. J. Stien, Vice President; C. Stone, Treasurer; F. D. Northland, Secretary; R. P. Bradley, 4418 South Wabash Ave., Chicago, Ill., Corresponding Secretary.

Custer Wireless Club.—Franklin Webber, President; Fred Cross, Vice President; Oakley Ashton, Treasurer; Walter Maynes, 438 Custer Ave., Los Angeles, Cal., Secretary.

Fargo Wireless Association.—Kenneth Hance, President; John Bathrick, Vice President; Earl C. Reineke, 518 9th St., Fargo, N. D., Secretary.

Forest Park School Wireless Club—W. S. Robinson, Jr., President; William Crawford, R. F. D. No. 1, Springfield, Mass., Secretary.

Frontier Wireless Club.—Chas. B. Coxhead, President; John D. Camp, Vice President; Franklin J. Kidd, Jr., Treasurer; Herbert M. Graves, 458 Potomac Ave., Buffalo, N. Y., Secretary.

Gramercy Wireless Club.—James Platt, President; John Gebhardt, Vice President; John Diehl, Treasurer; John Jordan, 219 East 23d St., New York, N. Y., Secretary.

Independent Wireless Transmission Co.—Starr W. Stanyan, 76 Boston Ave., West Medford, Mass., Secretary.

Northwestern Wireless Association of Chicago—Rolf Rolfson, President; H. Kunde, Treasurer; Edw. G. Egloff, 2729 Noble Ave., Chicago, Ill., Recording Secretary.

Hannibal (Mo.) Amateur Wireless Club.—Charles A. Cruickshank, President; J. C. Rowland, Vice President; William Youse, Treasurer; G. G. Owens, 1306 Hill St., Hannibal, Mo., Secretary.

Haverhill (Mass.) Wireless Association—Riedel G. Sprague, President; Charles Farrington, Vice President; Leon R. Westbrook, Haverhill, Mass., Secretary and Treasurer.

Independence Wireless Association.—Boyce Miller, President; Ralph Elliott, Secretary; Joseph Mahan, 214 South Sixth St., Independence, Kan., Vice President.

Jonesville Wireless Association.—Frederic Wetmore, President; Webb Virmylla, Vice President; Richard Hawkins, Treasurer; Merritt Green, Lock Box 82, Jonesville, Mich., Secretary.

Lake View Wireless Club.—E. M. Fickett, President; R. Ludwig, Treasurer; R. F. Becker, 1439 Winona Ave., Chicago, Ill., Secretary.

Long Beach Radio Research Club.—Bernard Williams, 555 E. Seaside Bvd., Long Beach, Calif., Secretary.

Manchester, (N. H.) Radio Club.—Homer B. Lincoln, President; Clarence Campbell, Vice President; Elmer Cutts, Treasurer; Earle Freeman, 759 Pine St., Manchester, N. H., Secretary.

New Haven Wireless Association.—Roy E. Wilmot, President; Arthur P. Seeley, Vice President; Russell O'Connor, 27 Vernon St., New Haven, Conn., Secretary and Treasurer.

Oakland Wireless Club.—H. Montag, President; W. L. Walker, Treasurer; W. R. Sibbert, 916 Chester St., Oakland, Calif., Secretary.

Oregon State Wireless Association.—Charles Austin, President; Joyce Kelly, Recording Secretary; Edward Murray, Sargeant-at-Arms; Clarence Bischoff, Lents, Ore., Treasurer and Corresponding Secretary.

Peterboro Wireless Club.—G. B. Powell, President; C. V. Miller, Vice President; E. W. Oke, 263 Engleburn Ave., Peterboro, Ontario, Can., Secretary and Treasurer.

Plaza Wireless Club.—Paul Elliott, President; Myron Hanover, 156 E. 66th St., New York, N. Y., Secretary and Treasurer.

Rockland County (N. Y.) Wireless Association.—W. F. Crosby, President; Tracey Sherman, Vice President; Marquis Bryant, Secretary; Erskine Van Houten, 24 De Pew Ave., Nyack, N. Y., Corresponding Secretary.

Roslindale (Mass.) Wireless Association.—O. Gilus, President; E. T. McKay, Treasurer; Fred C. Fruth, 962 South St., Roslindale, Mass., Secretary.

Sacramento Wireless Signal Club.—E. Rackliff, President; J. Murray, Vice President; G. Bunyard, Treasurer; W. E. Totten, 1524 "M" St., Sacramento, Calif., Secretary.

Santa Cruz Wireless Association.—Orville Johnson, President; Harold E. Sentor, 184 Walnut Ave., Santa Cruz, Calif., Secretary and Treasurer.

Southern Indiana Wireless Association—R. F. Vanter, President; D. C. Cox, Vice President and Treasurer; H. Hitz, Fairmont, Madison, Ind., Corresponding Secretary.

Southern Wireless Association.—B. Oppenheim, President; P. Gernsbacher, 1435 Henry Clay Ave., New Orleans, La., Secretary and Treasurer.

Springfield (Mass.) Wireless Association.—A. C. Gravel, President; C. K. Seely, Vice President and Treasurer; D. W. Martenson, Secretary; Club Rooms, 323 King St., Springfield, Mass.

Spring Hill Amateur Wireless Association.—R. D. Thiery, President; H. P. Hood, 2nd, 2 Benton Road, Somerville, Mass., Secretary and Treasurer.

St. Paul Wireless Club.—Thos. Taylor, President; L. R. Moore, Vice President; E. C. Estes, Treasurer; R. H. Milton, 217 Dayton Ave., St. Paul, Minn., Secretary.

Tri-State Wireless Association.—C. B. DeLaHunt, President; O. F. Lyons, Vice President; T. J. M. Daly, Treasurer; C. J. Cowan, Memphis, Tenn., Secretary.

Waterbury Wireless Association.—Weston Jenks, President; Alfred Upham, Treasurer; H. M. Rogers, Jr., 26 Linden St., Waterbury, Conn., Secretary.

Wireless Association of British Columbia.—Clifford C. Watson, President; J. Arnott, Vice President; E. Kelly, Treasurer; H. J. Bothel, 300 Fourteenth Ave. E., Vancouver, B. C., Corresponding Secretary.

Wireless Association of Canada.—W. Fowler, President; E. G. Lunn, Vice President; W. C. Schuur, Secretary and Treasurer.

Wireless Association of Montana.—Roy Tysel, President; Elliot Gillie, Vice President; Harold Satter, 309 South Ohio St., Butte, Mont., Secretary.

Wireless Club of Baltimore.—Harry Richards, President; William Pules, Vice President; Curtis Garret, Treasurer; Winters Jones, 728 North Monroe St. Baltimore, Md., Secretary.

Wireless Club of the Shortridge High School.—Robert C. Schimmel, 2220 N. Penn St., Indianapolis, Ind., President; George R. Popp, Vice President; Bayard Brill, Treasurer; Oliver Hamilton, Secretary.

For Practical Electrical Workers

Electric Lighting Circuits

By HENRY CLOWS

The maximum incandescent lamp load permissible on any branch circuit is 660 watts. That is, wiring must be so arranged that no set of incandescent lamps requiring more than 660 watts, whether grouped on one fixture or on several fixtures or pendants, will be dependent on one cut-out. This is an

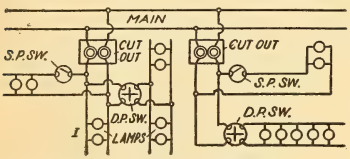
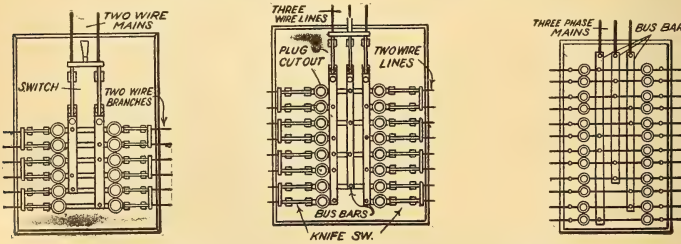


FIG. 1. LAMP CONNECTIONS

underwriters' requirement, but permission may be given in special cases by the local inspection bureau for departures from the rule.

The connection of lamps to circuits can be effected in innumerable ways, but the principles outlined in Fig. 1 are general. The lamps at (I) will burn as long as the main is alive. The other lamps are controlled by either single pole or double pole switches. Single pole switches should not be used for the control of circuits of capacities exceeding 660 watts, and three-point or three-way switches are considered the equivalent of single pole switches in this respect.

Panel box panels for two wire, three wire and three phase systems, are illustrated in Figs. 2, 3 and 4. A panel merely provides a convenient means of connecting (through fuses) the branch circuits to the mains. Switches may be used as in Fig. 2, in both the main and branch circuits, or switches may be omitted entirely, as in Fig. 4. Whether or not switches should be provided, is determined by conditions or convenience, as the only switch required on the lighting service of a building is the service switch. Fuses, however, are required to protect every branch circuit. Many satisfactory



FIGS. 2, 3 AND 4—PANELS FOR TWO WIRE, THREE WIRE AND THREE PHASE SYSTEMS

installations are in operation without switches, but switches are of great convenience for opening the circuits, for

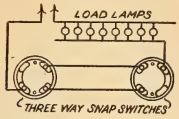


FIG. 5—CONTROLLING LAMP FROM TWO LOCATIONS

replacing fuses and for testing. Branch lighting circuits may be controlled by either flush or surface snap switches, mounted outside of the panel box.

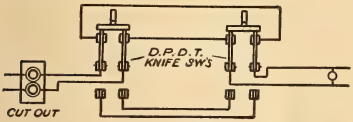


FIG. 6. TWO-LOCATION CONTROL WITH DOUBLE POLE SWITCHES

The method of controlling a group of lamps from either of two locations, with snap or flush switches, is shown in Fig. 5. Two special three-way switches, of either the flush or surface type, are required. These can be purchased. This scheme of wiring is much used for hall lights so they can be controlled from either the first or second floor.

Two-location control with double pole knife switches, is shown in Fig. 6.

The method of controlling a group of lamps from any one of more than two locations, with flush or snap switches, is shown in Fig. 7. Special switches made for the purpose are required. A three-way switch is used at each end of the

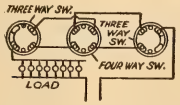


FIG. 7. GROUP LAMP CONTROL

circuit, and as many additional four-way switches are necessary as there are additional control locations. This method is also much used for wiring for hall lights.

An emergency or burglar circuit is shown in Fig. 8. This arrangement can be used where it must be possible to light certain lamps in a building from a certain location, irrespective of whether the switches normally controlling the lamps are closed or not. Closing the master

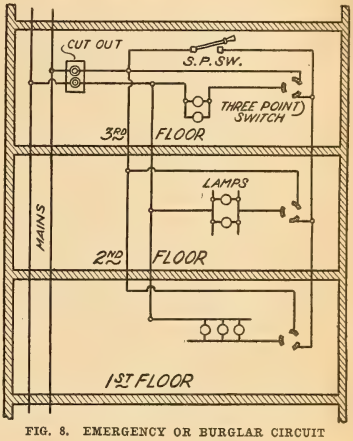


FIG. 8. EMERGENCY OR BURGLAR CIRCUIT

switch illuminates the house as might be necessary in case of fire, an invasion by burglars or other emergency.

Electrolier switches for controlling lamps in groups, as is often necessary in room lighting where there is a dome or

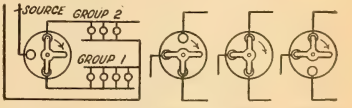


FIG. 9. ELECTROLIER SWITCHES

electrolier having several distinct circuits, are wired as shown in Fig. 9. Special snap switches of either the flush, pull, or surface type, are necessary. With the two-circuit switch, Fig. 9, with the switch handle in the first position all lamps are off, in the second position only those of Group 1 are on, in the third position

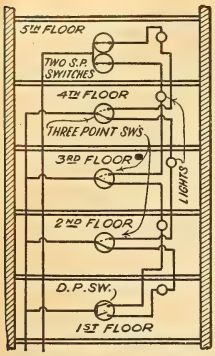


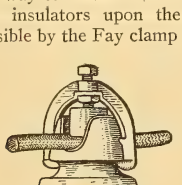
FIG. 10. CIRCUITS FOR STAIRWAY LIGHTING

those in both groups are on, in the fourth position only those in Group 2 are on. Then with the next quarter turn of the switch the first position is again assumed and all lights are extinguished. While the same principle is always used, all commercial electrolier switches are not arranged exactly as illustrated.

A circuit arrangement for stairway lighting is shown in Fig. 10, whereby one can illuminate the landing that he is on and the one above or below him as he goes up or comes down the stairs. The switch at each landing must be operated in passing. Two single pole switches are shown on the fifth floor. With these two switches the lamp on that floor can be left burning if desired.

Getting Rid of the Tie Wire

A new way to fasten electric wires to the glass insulators upon the poles is made possible by the Fay clamp insulator.



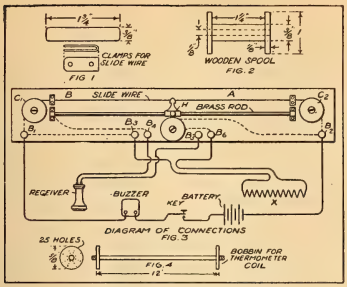
WIRE FASTENER

The clamp is of porcelain and both the insulator and wire are so made as to be installed with small loss of time, by hooking the jaws of the clamp under the insulator rim and turning the lock nut.

How to Make a Resistance Thermometer

The operation of the resistance thermometer depends upon the change in the resistance a conductor offers to the passage of a current of electricity through it, due to a change in its temperature. If the relation between the resistance of a coil of wire and its temperature is known, then its temperature may be determined at any time by simply measuring its resistance and looking up in a previously prepared table the temperature corresponding to the measured value of the resistance. The coil of wire, together with a Wheatstone bridge, would constitute a resistance thermometer, but a slide-wire bridge with a direct reading temperature scale under the wire is here described.

Obtain a hardwood board ⅞ by 7 inches and 3½ feet long, also 35 feet of No. 24 B and S gauge insulated manganin wire and 20 feet of No. 27 insulated manganin. Round the edges and corners of the board and give it several coats of shellac. Make two brass clamps, as shown in Fig. 1, from some 1/16 inch sheet brass. Next turn out three wooden spools like the one shown in Fig. 2, and shellac them. Mount the piece of No. 24 manganin wire by means of the brass clamps on the board, Fig. 3, the center of the wire being one foot from one clamp and two feet from the other, the clamps being equally spaced from the two ends of the board. The slide-wire should be one inch from the edge of the mounting board. Mount two of the wooden spools on the ends of the board as shown by (C_1) and (C_2). Provide six back-connected binding posts and mount them on the base as shown by (B_1), (B_2), (B_3), (B_4), (B_5) and (B_6) in Fig. 3. Place a piece of ⅛ or 3/16 inch brass rod on the board parallel to the slide-wire, one inch from it and ¼ inch above the surface of the board. Obtain a piece of thin brass tubing about 1¼ inch long and of such an inside



RESISTANCE THERMOMETER

diameter that it will slide along the brass rod. The sliding contact is carried by the brass tube and should be soldered to the under side of it. The lower edge of the sliding contact should be rather sharp so it will make contact with a definite point on the slide-wire. A small hard rubber handle (H) may be fastened to the tube and will aid in moving the contact along the wire.

One end of the brass rod should be connected to the binding post (B_4) by a copper wire placed in a groove on the underside of the board. Wind the free portions of the slide-wire on the two spools (C_1) and (C_2) and attach the ends to the binding posts (B_1) and (B_2), making connections on the underside of the board. Wind on the spool (R) the 20 feet of No. 27 manganin wire and connect the ends to the binding posts (B_2) and (B_6). The windings on the spools (C_1), (C_2) and (R) should be noninductive; that is, one-half of the turns should be wound around the core in one direction and the other half in the opposite direction. Connect the binding post (B_1) to (B_3) and the binding post (B_5) to (B_6) and the bridge proper is complete.

The thermometer coil is of copper wire and it, together with its leads, should have a resistance practically the same as the resistance of the coil (R) at ordinary room temperature, which is usually about 25° C. To construct the thermometer coil, proceed as follows:

Make a spool whose dimensions correspond to those given in Fig. 4. The spool should be made of some ⅛ inch sheet rubber, threaded and screwed on the threaded ends of the brass rod. Glue several layers of thin insulating cloth around the brass rod. Drill 25 small holes in each of the rubber ends and thread 25 feet of No. 40 B and S gauge, cotton-covered copper wire back and forth from end to end. Place this spool in a piece of brass tube to protect it mechanically. The tube should have a number of small holes drilled in it so that the temperature inside will always correspond to the temperature outside the tube. If this coil is to be used some distance from the bridge, leads of suitable length should be provided before calibrating, and their resistance should be comparatively low, No. 18 B and S gauge manganin wire being suitable.

A piece of heavy cardboard ¾ inch wide should be mounted directly under the slide-wire and it should extend from clip to clip. Carefully remove the insulation from the slide-wire between the clips by means of a good sharp penknife.

To calibrate the bridge wire as a direct reading thermometer, immerse the thermometer coil in a quantity of oil placed in a metal vessel. Arrange to heat this oil, using a good mercury thermometer as a standard. Bring the oil bath to a constant temperature, say 25° C., then adjust the resistance of the thermometer coil plus its leads to such a value that a balance is obtained with the sliding contact in the center of the total slide-wire or one foot from one clip and two feet from the other. Gradually raise the temperature of the oil bath and allow it to become constant at some higher value, say 30° C. (smaller steps may be taken if desired), and make a second balance and mark the point of balance on the cardboard. Continue in this way until a maximum temperature of, say, 100° C. is reached. Lower temperatures may be obtained by immersing the vessel con-

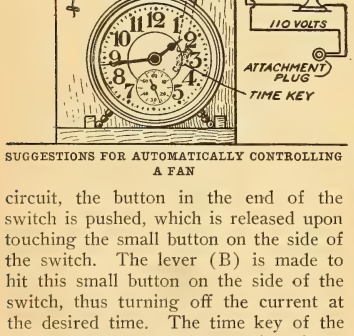
taining the oil in crushed ice or snow. Always make sure the temperature of the coil has reached a value corresponding to that indicated by the thermometer. Errors due to unequal temperatures of the oil and coil may be reduced by stirring the oil with a small paddle.

Instead of using a steady battery current, an interrupted battery current is used, it being interrupted by introducing an ordinary low resistance buzzer directly in series with the battery. The balance point is indicated by a minimum hum in the telephone receiver. A steady battery current and galvanometer may be used instead, if desired.

Turns the Fan Off

The scheme here suggested may be used to turn off the electric fan by the bedside without disturbing the sleeper, who may start the fan going when he retires.

A pendant push button switch may be obtained from any electrical supply house for 50 cents or less. To complete the

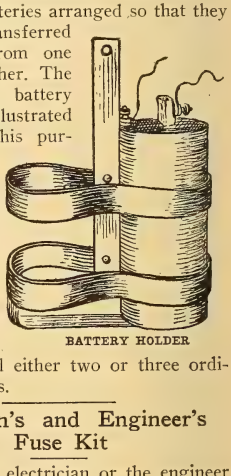


SUGGESTIONS FOR AUTOMATICALLY CONTROLLING A FAN

circuit, the button in the end of the switch is pushed, which is released upon touching the small button on the side of the switch. The lever (B) is made to hit this small button on the side of the switch, thus turning off the current at the desired time. The time key of the clock is made to push over the trigger (C), releasing the lever (B), which deals the button on the side of the switch a smart blow. The part of this lever which comes in contact with the button should have a piece of soft rubber or cork glued on to prevent noise. In winding the clock, the time key should be left so that in a quarter revolution of the key it will come in contact with the trigger (C), which on my clock allows the fan to run for about half an hour.—Wesley G. Paulson.

Battery Holder

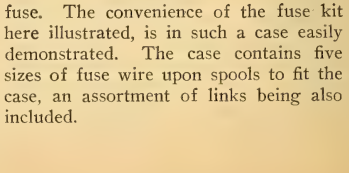
It is often convenient to have two or three dry batteries arranged so that they may be transferred altogether from one point to another. The Economy battery holder here illustrated serves for this purpose and is a skeleton holder made of ¾ inch enameled band steel. It may be hung from a nail or screw and is made to hold either two or three ordinary dry cells.



BATTERY HOLDER

Wireman's and Engineer's Fuse Kit

The house electrician or the engineer is often called upon to replace a blown

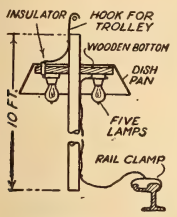


FUSE KEY

fuse. The convenience of the fuse kit here illustrated, is in such a case easily demonstrated. The case contains five sizes of fuse wire upon spools to fit the case, an assortment of links being also included.

Portable Street Light

The track gang on a street railway was working on a rush job of relaying a section of track, and as it was necessary to work all night, the question arose as how to light the tracks. As the gang was constantly moving forward, it would not pay to install arc lamps. This is how the problem was solved:



PORTABLE STREET LIGHT

Several medium sized dishpans, procured at a five and ten cent store, were fitted with wooden bottoms to which were fastened five sockets. A ten-foot pole was placed through the center of the pan bottom.

A hook of heavy copper was then attached to one end of the pole, and a wire connected it with the sockets. The sockets were connected in series to allow use of 110 volt lamps on the trolley circuit of 550 volts. The other terminal of the socket group was connected to a long wire, which in turn made connection to the rail. Thirty-two candlepower lamps were placed in the sockets.

Whenever the arrangement was moved all that was necessary was to remove the rail clamp and unhook the pole, move to the spot selected, clamp on to rail, hook on to trolley and there was plenty of light. Four of these furnished light for 50 men.—Harold L. Kessler.

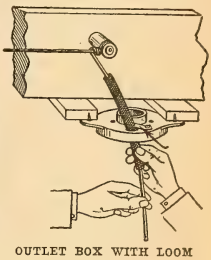
Preventing Gravity Cells From Creeping

Gravity batteries cause some inconvenience and muss by "spewing over." There are ways of preventing this, but the one I have found to be the most successful is as follows: After the battery has been made up place a layer of excelsior on top of the solution and pour in enough molten paraffin wax to completely cover.

This comes handy when the battery needs renewing, for by melting the edge of the paraffin with a blow torch it can easily be removed and replaced by again melting and allowing to cool. This cover prevents evaporation and creeping, and at the same time is porous enough to allow the gases to escape.—T. Dodd.

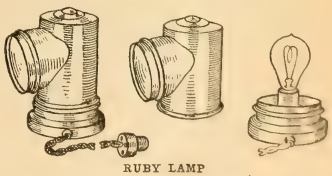
Keeps the Loom in Place

The electrician likes to leave his work in good condition for the fixture hanger. The protecting "loom" at the outlets is seldom firmly fixed on the wires. The Fancleve outlet boxes for concealed work offer something new to do this. Over each hole a flat steel spring projects slightly, so that when the conduit is in place it cannot be withdrawn from the box. The idea is to cut off enough conduit to be in the box to meet the terminal porcelain knob in the timbers, then push it through the box toward the knob. This can be done with two fingers, but would take a yoke of oxen to pull it out when once in place.


OUTLET BOX WITH LOOM HOLDER

Ruby Lamp

A convenient ruby lamp for the dark room is here shown, a sixteen candle-power lamp being used. The body of the lamp is of heavy tin plate and is copper oxidized.


RUBY LAMP

Electricity the Silent Salesman

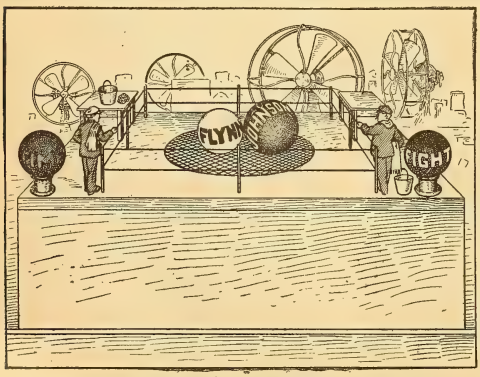
Some helpful hints on the use of electric current in getting up show window displays. The following schemes have all been used with remarkable success.

A "White Hope" Fan Display

A clever window display appealing to the "fight fan," and attracting unusual attention from everybody, is made use of to advertise electric fans.

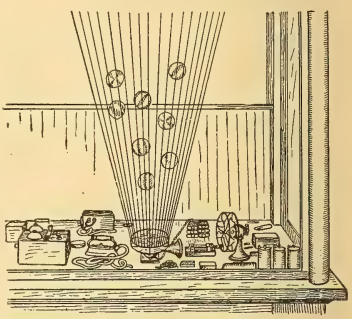
Upon a small platform a miniature ring is roped off. In opposite corners are trainers with towels, sponges and pails. An opening in the top of the box platform and within the ring is covered with wire netting. Upon this netting rest two rubber balls, one white, labeled "Flynn," the other black, marked "Johnson." At each front corner of the platform is an incandescent lamp with a ground glass globe. Upon one is printed "Fight," upon the other, "Time." Inside the box platform and directly under the ring is an electric fan arranged to blow air up through the opening and, of course, against the balls.

The device operates as follows: With the current turned on, the lamp marked "Fight" lights up, the fan runs and the black and white battlers bump each other about the ring, the air draft being regulated to a point to accomplish this. Then the "Fight" light goes out, the "Time" light is automatically turned on, the fan stops, and the balls come to rest until the "Fight" lamp again lights up.



"WHITE HOPE" FAN DISPLAY

Fan Time Display



THE BREEZE KEEPS THE AIR BAGS BOUNCING

An enterprising dealer in electrical goods has put an electric fan to good use in an attractive window display. The fan, with wire guard attached, is laid face upward on the floor of the show window, and numerous pieces of twine are fastened to the guard and to the ceiling, forming a space enclosed by twine and shaped like an inverted cone. In this space are placed four or five air-filled balloons, which, when the fan is not in operation, lie on the guard of the fan. When the current is turned on, they perform a merry game of tag in the cord cage. W. H. Dennison.

SCIENCE EXTRACTS FROM FOREIGN JOURNALS

PLACING PLATINUM WIRE IN QUARTZ TUBES

While it is an easy matter to mount platinum wires in glass, such as we find in electric lamp bulbs in order to bring the current to the filament, it is quite a problem when it comes to using the new quartz tubes which are being used for mercury vapor lamps, or other kinds of quartz vessels such as experimenters are working with. A Paris constructor, M. Berlemont, succeeds in doing this by a new method. The difficulty is that quartz melts at a very high heat, 1800° C., and expands very little under heat, while the metals melt below this point and also expand much more. He first tried to fix the wires directly in the quartz by melting, and then used other methods, such as placing glass or enamels between the wire and the quartz. However, he came back to the direct method, and is now able to fix the wire in the quartz, using a wire made of an alloy of platinum and iridium. Thus he could obtain a tight joint which would hold well even at a high heat.—*Académie des Sciences' Report.*

HOLLAND FISHING BOATS EQUIPPED WITH WIRELESS

Some of the fishing boats in the Holland ports are fitted with a simple and convenient wireless outfit, and this is a great aid to such craft, as they can send signals to shore about the results of the fishing, or can say when they are to come to port, or ask for a tow boat. The Holland boats have only one antenna, which is a copper wire stretched above the deck between two masts and a wire then leads down to the apparatus. The receiving set is in a compact box and uses a detector fitted in a watch case, also a small regulating coil and a telephone receiver, with two dry battery cells.—*Revue Electrique.*

LAMPS AS TIME-LIMIT SIGNAL TO SPEAKERS

When, a few years ago, Parliament became a recognized institution in Russia, the question of the length of speeches early engaged the attention of the framers of the new adjunct to an ancient Constitution. It was agreed that fifteen minutes was a reasonable allowance per head, and an ingenious contrivance was introduced with design to mark off the allocation. On each man's desk was fixed a red lamp fed by electricity. When the member rose to speak, the lamp lit up. At the end of a quarter of an hour it automatically went out, and simultaneously the orator, even if he were in the middle of a sentence, shut up.—*The Observer.*

WIRELESS TELEGRAPHY ON AEROPLANES

Some very good experiments on the use of wireless telegraphy with aeroplanes were made not long since at Chartres, in the region of Paris. Starting from the aerodrome, the pilot Frantz carried on board M. Rouzet, the inventor of the wireless apparatus, and made a sail of about 100 miles around the country, with 30 miles as the greatest distance from the starting point, where a small wireless outfit had been set up at the aerodrome and where several of the army officers were taking part in the trials. They could receive all the news of the aeroplane observations and the signals were very good even though the antenna wire was a short one. On the aeroplane the antenna consisted of a 100-foot wire hanging down, and the motor served to drive a small dynamo for producing the current. The dynamo and all the rest of the apparatus is especially light, and all is well enclosed so that there is no danger of electric shocks to the operator. The wire is mounted on a reel and can be rolled up in fifteen sec-

onds, and there is a safety device for cutting the wire in case the aeroplane should descend rapidly.—*Industrie Electrique.*

HOTEL WITH 200 ELECTRIC CLOCKS

A hotel with 200 electric clocks has been opened recently in Liverpool, this being the Adelphi Hotel belonging to the Midland Railway Company. It has uniform and accurate time distributed throughout the building by electrical impulse dials on the Synchronome system, all the dials being wired up and controlled by a master clock. With the exception of 40 in the service and the servants' quarters, the dials are of handsome enamel on copper and are set in elaborate brass hand-finished cases which the architect designed so as to be in harmony with the surroundings. The bedrooms have dials fixed on the wall, and what is a good point is that they run very silently so as not to disturb rest during the night.—*Electrical Review, London.*

COATING BALLOONS WITH ALUMINUM POWDER

Balloon envelopes are sometimes given a coating of aluminum powder so as to protect the rubber tissue from the bad effect of the sun's rays, and it is found that with the metal coating there is less difference in heating and cooling when the balloon passes from cloud shadow to sunlight. But the metal also has a disadvantage, as it is likely to become electrically charged when in the air, owing to atmospheric electricity. In one case, on April 22, a German spherical balloon was flying near the Harz mountains, and it took fire from an electric spark which occurred when the gas valve was opened. The spark set fire to the gas. Somewhat the same kind of an accident happened to a military captive balloon at Strassburg. It broke loose from its moorings and rose high in the air, then came down to the ground. No doubt it became highly charged with electricity during the flight, for a spark set fire to the gas as soon as the officers opened the valve. Not long ago an army balloon in Italy with metallic coating was struck by lightning, and this seems to be the only case where a captive balloon suffered in this day.—*Cosmos, Paris.*

PEAT FIELDS OF BAVARIA

Southern Bavaria has immense peat fields which can be used for running electric plants and the attention of engineers is being called to the matter; electricity could thus be had very cheaply. The peat bogs lie mainly in the neighborhood of the Danube and it is estimated that they cover an area of 500 square miles. Even supposing that only 80 per cent of this surface is worked, and that the layer is but three feet in depth, estimating a cubic yard of peat to weigh about 100 pounds this would mean no less than 50 million tons of fuel from this source. Should the peat fields be worked all the year round, power could be obtained to the extent of 700,000 horse power for the space of 50 years.—*Elektrotechnik Maschinenbau.*

INSPECTING EGGS WITH X-RAYS

Eggs are now being examined by X-rays in Denmark and England, and the new method is said to be a very good one.

A special dark room is installed in the quarters where the eggs arrive, and the apparatus consists of a closed lantern containing the electric tube for producing the rays. In the front of the lantern is a small opening of about the size of an egg, so that the rays can pass through the egg. The rays throw the shadow of the egg upon a screen placed in front. Fresh eggs are seen to be quite clear, but any defects are shown up as small spots appearing on the screen. Such eggs are put in the second class, but if the spots are too large they are rejected.—*La Nature.*

Inventions and Patents

By A. P. CONNOR

Many who have what they are satisfied is a patentable invention have a very incomplete idea of how to proceed in taking out a patent. Some, moreover, believe that all the world is waiting to steal their ideas—patent attorneys included. We have in mind one inventor in particular. He had a "revolutionary" invention but did not know what to do with it. So he wrote (address general delivery) to a publisher for the name of a reliable patent attorney. On getting the information he appeared before said attorney with witnesses and asked advice. He would not tell the attorney what the device was, or what it was for. He did tell him, however, that he, the attorney, need not hope to follow the trail of the invention for he, the inventor, moved mysteriously several times a week, taking long rides on elevated trains and dashing in and out of alleys from one boarding place to a new one. Of course, the attorney was powerless to help him in his dilemma. Now the Patent Office is to protect the inventor and it is a simple matter to get a patent on a new and meritorious device. There are a few simple rules of procedure explained in the following article, which will be concluded in the next issue.—EDITORIAL NOTE.

GENERAL

That humble legal instrument issued by the Government and known as a patent is the main cause of a great deal of our present industrial development and progress, because of the protection it affords and the encouragement it gives the inventor, and those who instituted the system which is built around it deserve great glory and credit. The patent in this country may be defined as being a legal instrument issued under the seal of the Government to the inventor satisfactorily complying with certain conditions outlined by law, and which gives the inventor a monopoly of his invention for seventeen years. The inventor may do anything he wishes with his invention; that is, he may sell it, or he may lock it away if he so choose and prevent anyone else from using it. In fact, if anyone wishes to have an adequate idea of the extent of the monopoly he has only to read the late case of Dick before the Supreme Court of the United States, which case caused quite a stir in the commercial world so recently.

A patent may be obtained by any person who has invented any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvement thereof, and in each case the novelty and utility must be that defined by the statute. If neither novelty nor utility are present, or if one is there and the other absent, a valid patent can not be obtained, but the matter of patentability is a difficult one to decide in many cases even under the best conditions, and it is always advisable to get the opinion of an experienced patent attorney on the subject before going to the expense of applying for a patent.

A machine in the Patent Office language is a term broad enough to include any mechanical device, as for instance a button hook, a wrench, a motor, a cotton picker, a plow, an insulator and almost any other device capable of being used in the mechanical arts. The term composition of matter embraces special substances which produce special results, such as chemical compounds and mechanical mixtures, as, for instance, dyestuffs, adhesives, explosives, paints, and multitudinous other well known classes of materials. The term manufacture is an expression which serves to classify those classes of invention which might be difficult to include in the other terms, and

serves to give a certain amount of discretion to the Commissioner of Patents in his determination of patentable objects. The term new and useful art is particularly clear to the layman but is also broad in its scope, as it includes new processes for manufacturing materials, and in the electric class would include those special systems of wiring, as in the case of duplex, diplex and other systems of telegraphy.

There are also patents granted for designs of all kinds, but these are treated differently from those already referred to, and they are given for designs of machinery, manufactures, etc., some examples of which are wall paper patterns, specially and artistically formed furniture and hardware, and other articles which are given some particular design for artistic rather than for efficiency reasons.

Trade-marks are also examined in the Patent Office and registered there, but they are intended to identify the goods of one corporation from those of all others in the same line of business. This subject, however, will not be treated of in this article.

THE APPLICATION

The application for patent usually includes a petition to the Commissioner of Patents, a specification, an oath and sheets of drawings. In addition a model is sometimes required and a power of attorney included. The petition is a communication asking the Commissioner of Patents to grant a patent to the petitioner, that is, the inventor, and includes the latter's address and other incidental matter. The power of attorney is usually placed after the petition and is signed by the inventor. The specification is divided into three main parts which are technically known as the preamble, the specification proper, and the claims. The first is a public declaration by the applicant that he has made the invention referred to. The specification proper describes the invention, its purpose and its operation in such language as will enable all those who are in the profession it refers to, fully to understand it, and where there are drawings it refers to the same, so that they will be clearly understood. Finally come the claims, which in technical and in legal language positively point out the invention, and to a very great extent control the value of the patent.

The drawings required to illustrate the invention must be made to comply with the strict rules of the Patent Office, and are usually beautiful pieces of draftsman's work when drawn by an experienced patent draftsman. The drawings have to be of a high grade character in order that the drawings will show up well in the printed publications issued by the Patent Office. The drawings are signed by the inventor or his attorney for him in the presence of two witnesses, who also attest their signatures.

The inventor must sign the specification in the presence of two or more witnesses who also attest theirs, and the inventor also takes the oath in the presence of a notary public and signs the same. The notary or whoever administers the oath to the inventor must then put his official seal on the papers in such a way as to identify the whole application papers, for which purpose the papers are in most cases ribboned together with the ends of the ribbon brought under a paper seal which receives the impression of the notary's seal.

(To be Concluded.)

NEW BOOKS

THE CINEMATOGRAPH AND NATURAL SCIENCE. By Leonard Donaldson. London: Ganes, Limited. 1912. 88 pages with 25 illustrations. Price, 66 cents.

A volume in which the author shows the value of the moving picture as an educator, serviceable in laboratories, hospitals, colleges and in public and private schools.

THE MODERN BIOSCOPE OPERATOR. London: Ganes, Limited. 1911. 181 pages with 29 illustrations. Price, 83 cents.

A book written for the moving picture operator by men who have been in the business. The subject matter is presented in a practical way.

On Polyphase Subjects

From Diamond to Coke

There has been accomplished the transformation of a diamond into a black coke-like mass. This was achieved by the action of cathode rays in a high vacuum. The diamond first became red, and then intensely white-hot, and finally, at 11,200 volts and 48 milliamperes, it disintegrated, increased considerably in volume, and assumed the appearance and consistency of coke.

The temperature at the time of disintegration was estimated to be 1,890°. Differences were observed in the spectra of the gases in the vacuum tube before and after the operation, but they were not sufficiently marked to determine with exactitude any variation in the nature of the gases.

New Discoveries Regarding Magnetic Metals

It was unknown before 1903 that alloys of non-magnetic metals could acquire permanent magnetism. The alloys of manganese, with arsenic, aluminum, bismuth, tin, antimony, and boron, become, if copper is present permanently magnetized after being in the presence of powerful electrical fields. These alloys are best made by adding the third metal to copper-manganese. Heating these alloys brings out various curious properties. If the copper-manganese is warmed as by the hand, it is not magnetizable. The moment, however, it is cooled, as by cold water, it again reacts to a magnet. This fact was announced to the London Faraday Society by Professors Hilpert and Dieckman a short time ago.

Electricity and Memory

There has been presented to the Royal Society at London a paper on the neurons cells of the brain in their relation to the faculty of memory. After stating that as with the other tissues of the body, so with the cells of the brain, evidence of lessening power and activity appears with the passage of years, there is adduced the interesting fact that the line of present investigation demonstrates that the electrical current through the brain rotates its molecules to such a degree as to produce a most noticeable physiological response in the direction of improved memory.

The Production of Hydrogen

Under the stimulus of practical science the work of the world widens and intensifies, so that there is a constant demand for better methods of producing certain substances that formerly were little used. One of these is hydrogen, for which there is a rapidly increasing demand for use with dirigible balloons, for the manufacture of tungsten lamp filaments and for processes that require the employment of the oxy-hydrogen blowpipe. Two principal processes are at present used in producing hydrogen, one being electrolytic, and depending upon a cheap supply of electric energy to decompose water; the other produces the gas by passing steam over red-hot iron. The electrolytic method has been largely developed in Germany and the other in England. But the problem of producing hydrogen cheaply on a large scale has not yet been satisfactorily solved.

"How do you feel about being on the water wagon?"

"Well, I feel better off."

* * *

Lulu—"I've never met a man who really interested me."

Mary—"What kind of a man do you want?"

Lulu—"Oh, a man who'd do things and make it necessary for me to write to the heart to heart department of some magazine for expert advice."

* * *

"Dear Clara," wrote the young man, "pardon me, but I'm getting so forgetful. I proposed to you last night, but really forgot whether you said yes or no."

"Dear Will," she replied by note, "so glad to hear from you. I know I said 'No,' to some one last night, but I had forgotten just who it was."

* * *

Physician—"From a hasty examination, I am of the opinion that you are suffering from clergyman's sore throat."

Patient—"The h—l you say!"

Physician (quickly)—"But it is quite possible that I am wrong—I will look again."

* * *

In a recent examination in machine design in a Chicago technical High School, the class was asked to define "Stress and Strain." A Chinese student made this answer:

"Stress will be happened if, when a piece of machinery gets outside of the factor of safety and then something hits it a blow, why it will break right off."

* * *

The new Swedish cook, who had come into the household during the holidays, asked of her mistress:

"Where bane your son? I not seeing hem 'round no more."

"My son," replied the mistress, pridefully. "Oh, he has gone back to Yale. I miss him dreadfully, though."

"Yas. I know yoost how you feel. My broder, he bane in yail saix times seence Tanksgaving."

* * *

"Is Mrs. Gillet a well-informed woman?"

"Well, she's on a party wire."

Said the electric light promoter to the mill stream, "I need your help." Said the mill stream to the E. L. P., "Well, I'll be dammed."

* * *

Augustus—"I'm not fond of the stage, Violet, but I hear your father on the stairs, and I think I had better go before the foot lights."

* * *

Teacher—"Appropriate means fit. Can you give me an example?"

Willie—"No, I can't; but our old cat can. She has 'em."

* * *

She—"In a way, getting married is like using the telephone."

He—"How so?"

She—"One doesn't always get the party one wants."

* * *

"Will you have anything on your face, sir, when I am through?" asked the barber.

"You might leave my nose there," answered the man in the chair.

* * *

"Money isn't everything," sighed the young man.

"Of course not," said the girl. "I know of a couple that started housekeeping nicely on tobacco coupons alone."

* * *

"Look a-here, Malvina!" cried the old man, shaking a horny finger at the bills the rural free delivery carrier had left, "mustard plasters from Josyin's, fifty cents; six teeth pulled at Dr. Pollard's, three dollars! There's three dollars and a half in one week spent for your own private pleasure. Do you think, woman, I'm made of money?"

* * *

Willie—"Pop, what are 'ancestors?'"

Father—"Well, I'm one of yours—your granddad is another."

Willie—"Oh! But why is it that folks brag about them?"

* * *

Chappie—"Electricity is wonderful. I tell you, it makes one think."

Miss Cutting—"Yes; why don't you get a battery?"

SOME ADVENTURES WITH A VACUUM CLEANER
"I DONT SEE ANY 35 DOLLARS WORTH"
"OH FATHER SEE MY NEW FEATHER! THE TAX WAS 35 DOLLARS"
SIP! - PHT
"MOTHER! COME QUICK! PIPE THE BIZARRE ORIFICE I HAVE FOUND!"
CHILD GERM
"OH FATHER COME QUICK! BRING GRANDPA & GRANDMA
MOTHER GERM
JUST THEN SOMEONE STARTED THE MACHINE
PHT
PHT
STP
PHT
BR-BR
BR-BR
BR-BR
BZ-BR-BR
THE PURSUIT OF THE WICKED FLEA
(NO MAN PURSUETH)
A NEW PLACE TO LOOK FOR MISSING COLLAR BUTTONS
"OH JOHN-LOOKIT! SEE WHAT A FUNNY LOOKING MAN OUT IN THE STREET!
PSYCHE NOT
WHERE? I DONT SEE HIM"
A TIP FOR LADIES WITH TIGHT-WAD HUSBANDS
DEBRA

Common Electrical Terms Defined

In this age of electricity everyone should be versed in its phraseology. By studying this page from month to month a working knowledge of the most commonly employed electrical terms may be obtained.

RESISTANCE BOX.—An inclosure containing a number of resistance coils so arranged that one or all may be placed in series on the circuit. The most common application is found in the Wheatstone bridge and in the motor starting box.

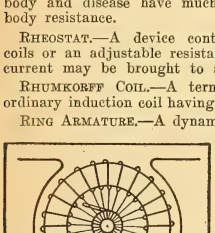
RESISTANCE COIL.—A coil of wire used to control the current in a circuit. (See Resistance Box.)

RESISTANCE OF THE HUMAN BODY.—Resistances varying from 350 to 8,000 ohms have been determined, but so much depends upon the contacts and their application that these results are not dependable. It is also asserted that moisture upon the surface of the body and disease have much to do with the body resistance.

RHEOSTAT.—A device containing resistance coils or an adjustable resistance by which the current may be brought to a fixed value.

RHUMKORFF COIL.—A term applied to the ordinary induction coil having a circuit breaker.

RING ARMATURE.—A dynamo or motor armature in which the coils are wound spirally around a ring-shaped or hollow cylindrical core. (See cut.)



Ring Armature

ROCKER.—A movable ring mounted about the commutator of a dynamo or motor and to which the brush holders are attached. By moving the rocker back and forth the brushes are given the proper position upon the commutator.

RODDING A CONDUIT.—In drawing a cable into a straight conduit a number of rods are placed in the conduit and connected together one after another end to end and crowded through until the first rod comes out at the far end. A rope is then pulled through by the rods, which are uncoupled as they are drawn out. The rope is used to haul in the cable.

ROSETTE.—A porcelain piece placed upon the ceiling from which to anchor the drop cord of a suspended incandescent lamp.

ROTOR.—In an induction motor the rotating mass of short-circuited conductors.

SAL AMMONIAC BATTERY.—See Battery, Sal Ammoniac.

SATURATED.—A liquid is saturated when it has dissolved all of a salt that it will at ordinary temperature, some of the salt remaining on the bottom of the vessel.

SECONDARY BATTERY.—A combination of a number of storage cells to form a single source of current supply.

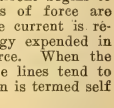
SECONDARY CURRENT.—The current induced in a second wire or coil by the current flowing in an adjacent wire or coil. The current taken from a transformer or an induction coil is secondary current.

SELENIUM.—An element resembling sulphur and tellurium. It is a conductor of electricity under certain conditions. It has the peculiar property of being highly resistant to the flow of electric current in darkness, but when light falls upon it selenium becomes a fairly good conductor.

SELF-EXCITING DYNAMO.—A dynamo in which the current for the field coils is furnished by the machine itself.

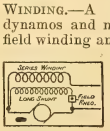
SELF INDUCTION.—When a current begins to flow in a wire, magnetic lines of force are formed about the wire and the current is retarded on account of the energy expended in building up these lines of force. When the current supply is cut off, these lines tend to prolong the current. This action is termed self induction.

SERIES.—A term used in speaking of the method of connecting up lamps or cells of battery. In batteries so connected, the zinc of one is connected to the carbon of the next. In lamps so connected the current passes through one after the other. (See cut.)



Series Connection

SERIES AND LONG SHUNT WINDING.—A winding in dynamos and motors in which there is a series field winding and also a shunt winding connected across from terminal to terminal of the machine. The shunt winding may be looked upon as a shunt to the outside circuit or as a shunt to the armature winding and series field. (See cut.)



Series and Long Shunt

SERIES AND SHORT SHUNT WINDING.—A compound winding in which the shunt winding is connected from brush to brush.

SERIES MOTOR.—A motor in which the field winding is in series with the armature winding.

POPULAR ELECTRICITY MAGAZINE

In Plain English

HENRY WALTER YOUNG, Editor

Vol. V | **September, 1912** | **No. 5**

CONTENTS

	Page
ELECTRICITY IN SAFEGUARDING SEA TRAVEL	401
Extremes Meet in the Antipodes	405
Hospital Signal Systems	406
A Combination Danger Signal	407
Baby Jumbo's Heart Beats	407
The Ideal Insulator	408
Hotel for Radium Bathers	408
The Electrical Directory	409
Mine Mules and the Trolley Wire	409
THE MAKING OF THE NAVAL ELECTRICIAN	410
Coal Mines Turned into Gas Retorts	413
Rules Recommended by Resuscitation Committee	414
The Great Proctor Sign	413
Combustion Train Determines Carbon in Steel	415
BRINGING WATER TO NEW YORK FROM THE CATSKILLS	416
Mayor of Wheeling in His Decorated Electric	419
Novel Searchlight Advertising in Baltimore	420
An Insidious Loss that Invites Attack	421
SOME SECRETS OF ELECTRICAL STATECRAFT	422
A Pull-Chain Adapter	426
Novel Tube Lamp	426
An Electrical "Spelling" Machine	427
Washington Monument's Lightning Rods	427
THE PATHFINDERS OF THE WIRES	428
Lamps on Crossing Gate	431
New York's Electrical Fountain	432
Electricity Conquers the Welsh Orme	433
An Old-Time Mine Signal	433
HYDRO-ELECTRIC WONDERS IN CALIFORNIA	434
Keeps Horses Cool and Comfortable	439
Death from an Improvised Electric Needle	439
Complexity of Telephone Field	439
Miniature Lamp Letter Sign	440
Electrical Warmers for Baby Cribs	441
Evil Lighted into Harmless Gaiety	441
The Largest Direct Current Dynamo	441
CHINESE STUDENTS STUDY AMERICAN TELEPHONE METHODS	442
Artistic Rest Stations in Pasadena	444
Outdoor Electric Advertising	445
COLLEGE TRAINING OF ELECTRICAL ENGINEERS	445
Unique Electric Sign	448
Recording Eclipse with Selenium Cell	449
Corn Cleaning Advertising Device	449
Boron in Cast Copper	449
Immense Generators of the Keokuk Plant	451
Ohio Electric Light Association	452
Surface Cars on Elevated Lines	453
Scientists Listen to Lights Noises	454
Flies Avoid Fan Breezes	454
Electric Line up Mt. Washington	454
Electric Current at Work	
The Electro-Magnet a Veritable Aladdin's Lamp	455
Audiffren Refrigerating Machine	457
Flexible Lamp Arm	458
Portable Polishing and Grinding Motor	458
Lamp Adjuster	458
Water Power of Iceland	458
Electric Meat Cutter	459
Reciprocating Motor Pump	459
The Electric Felting Tool	459
An Electric Scrubbing Machine	460
Telltale Lamp for Heaters and Irons	460
Mercury Lightning Arrester	461
The Flexalite Candle	461
Platers' Tank Magnet	461
ELECTRICAL MEN OF THE TIMES. Waldo Arnold Layman	462
Providing Pure Air in Telephone Vault	463
Electricity in the Interest of Women	
A Woman's Artistic Work	464
An Illuminated Ice Box	465
A GLIMPSE INTO JAPANESE HOME LIFE	466
Chemistry and Household Science	468
Mission Street Light Fixtures	468
Woman and the Electric Motor	469
Mountain Breezes by Wire	470
Electric Cooking Reduces Shrinkage	470
The Port-A-Lite	470
El Grillo	471
Emancipated	471
Electricity Enhances Jewels	471
Just Plain Mothers	471
Junior Section	
Deaf Children Visit Telephone Exchange	472
Electro-Magneto Rotation Experiment	473
Static Electric Top	474
The Magic Buzz Saw	475
An Electric Weather Vane. By Karl Koch	476
Popular Electricity Wireless Club	
HOW UNCLE SAM TRAINS HIS SAILORS IN WIRELESS	478
Radio-Telegraphy in Time Regulation	479
Photograph of a Rotary Spark Discharger	480
Wireless to Stop Trains	480
Questions and Answers in Wireless	481
That Condenser Formula	483
New Wireless Call Letters	483
Directory of Wireless Clubs	483
For Practical Electrical Workers	
Motor Holder	485
To Prevent a Transmitter from Packing	485
Suggestions in Scale Lighting	485
ELECTRIC WIRING	486
Cord Adjuster	489
An Electric Toaster	490
Extension Bells for Annunciator	490
Division Bell by "Wire"	490
Truck for Handling Armatures	491
Bank Lighting Hints	491
High Furnace Temperatures	491
Receiver Casings of Metal	491
Atmospheric Electricity	492
For the Milkman	493
For the Electrician in Fireproof Buildings	493
A Piano Lamp	494
Automobiles Horn Factory Signal	494
Farming by Electricity Demonstrated	494
Tray for Telephone Receiver	495
The World's Telephones	495
Garden Hose Display	496
Grass Cutting Advertisement	496
Wheel of Flags	496
The Rolling Auto Tire	496
Demonstrates Safety Razor Blade Sharpener	497
A Basket of Glowing Fruit	497
Emphasizing Window Displays	497
Watch the Wheels Go Round	498
Butterfly Exhibit	498
Wig Advertising	498
Miscellaneous	
ELECTRICAL SECURITIES	499
Digging Post Holes with Dynamite	502
Attractive Wagon Display	502
INVENTIONS AND PATENTS	503
New Books	505
Electrical Demonstrations for French Farmers	506
Wireless on Ferry Boats	506
Gyroscope Exhibit	506
Electrical Railroad Signal	506
Damming the Historic Rhone	507
Radium Rays from Gas Mantels	507
International Wireless Congress	507
Danish Professor's New Battery	508
French De-Tinning Process	508
The "Oceanic Letter"	508
Cheap Fuel of the Bad Lands	509
Vail Gift to Boston "Tech" Library	509
Short Circuits	510
Common Electrical Terms Defined	512

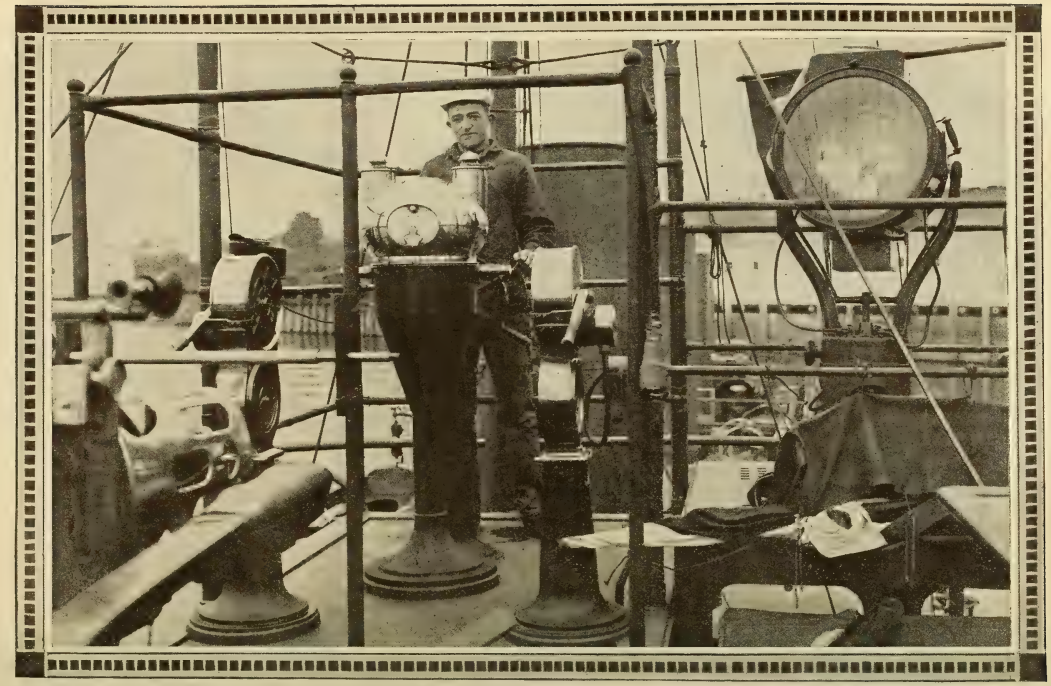
RENEWALS When your subscription expires, you will find a renewal blank enclosed here. You should fill out and return with remittance at once to avoid missing a number. Positively no copies will be mailed on any subscription after same expires unless renewed, and we cannot agree to begin subscriptions with back numbers. The date on wrapper of your magazine shows issue with which your subscription ends. The extension on this date to period covered by renewal is sufficient receipt. If any other is desired it should be requested at time of renewal.

CHANGE OF ADDRESS Notify us promptly of any change in your address, giving both the old and new location. Since our mailing list for each issue closes the 5th of the preceding month (i. e., list for February closes January 5th), changes received after the 5th must necessarily take effect with issue for second month following. Postmaster as well as Publisher should always be notified of changes in order to forward mail sent to old address.

ISSUED MONTHLY BY POPULAR ELECTRICITY PUBLISHING CO., Commercial Bldg., Chicago, Ill.
YEARLY SUBSCRIPTION, $1.50; CANADIAN, $1.85; FOREIGN, $2.25; SINGLE COPY, 15 CENTS

No additional copies will be sent after expiration of subscription except upon renewal.
Entered as Second Class Matter April 14, 1908, at the Post Office at Chicago. Under Act of March 3, 1879.

Copyright 1912, by Popular Electricity Publishing Co.



THE ELECTRICAL EYES OF THE SHIP—SEARCHLIGHT SIGNALLING APPARATUS ON BOARD A WARSHIP

PUBLIC ... TECHNICAL LIBRARY

Popular Electricity
In Plain English

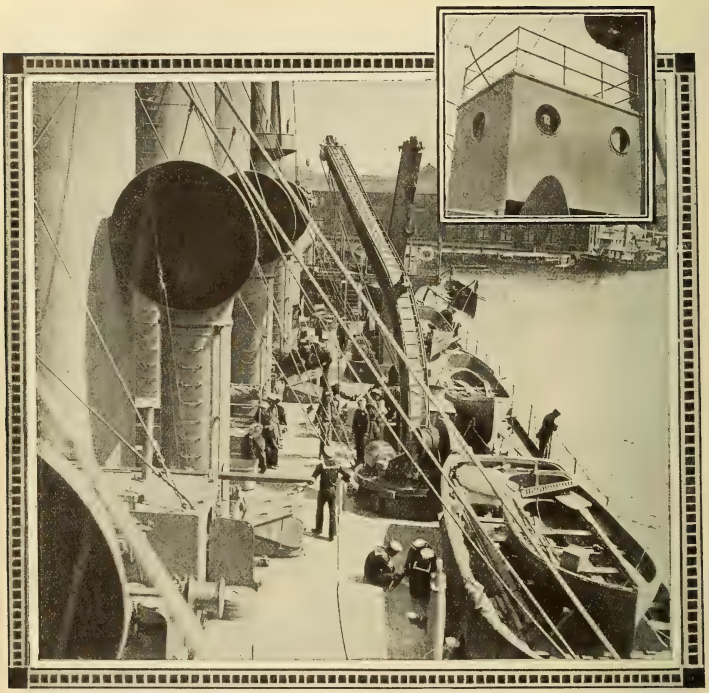
VOL. V SEPTEMBER, 1912 No. 5

Electricity's Part in SAFEGUARDING SEA-TRAVEL

By WALDON FAWCETT

The lessons of the Titanic disaster, unlike the admonitions from some similar tragedies in the past, are manifestly to be taken to heart. Already we find that the United States Government has acted in the premises. Congress is engaged in stiffening the legislative requirements with reference to the safeguarding of human life at sea; Germany, Great Britain, and other maritime powers are coöperating to standardize the equipment of the merchant marine, and the shipbuilders and vessel owners themselves appear to be in earnest in an effort to remedy the defects disclosed by the recent catastrophe. However, the deeper the investigation into the subject, the more apparent it becomes that electricity is the force which must be most heavily depended upon to minimize the dangers of navigation.

One utilization of electricity which will certainly be dictated by the costly experience of the Titanic involves the placing of powerful electric searchlights on all large passenger-carrying vessels in the oceanic trade. Indeed, it seems inexplainable and inexcusable that this has not been done before. For years past the searchlights have been considered indispensable on the warships of the American and foreign navies, and they have likewise been used with excellent effect on many steamers on our Great Lakes and on rivers such as the Hudson. To be sure, it is admitted—as per the argument of some of the unprogressive old-timers—that searchlights on ocean liners would be of little aid in a fog, but the Titanic disaster proves that the fog is not



DECK OF A WARSHIP SHOWING DISPOSITION OF LIFEBOATS, WHICH ARE LAUNCHED WITH ELECTRIC CRANES. ABOVE IS THE TYPICAL WIRELESS CABIN

the only menace of the ocean, although perhaps the most dreaded one. A powerful searchlight will, with its finger of light, point out objects from three to five miles distant, and such illumination could not fail to be of the greatest assistance to a vessel when passing through an ice field.

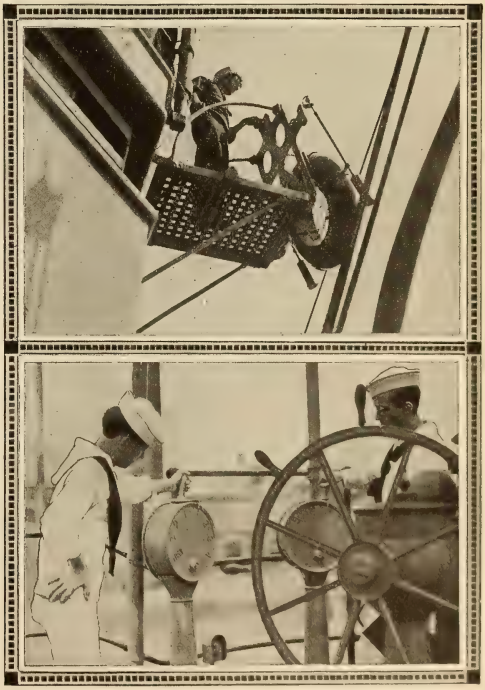
The Titanic disaster but added, of course, to the overwhelming mass of evidence as to the value of wireless telegraphy in the field of navigation. It disclosed, however, opportunities for improvement in the system of operation that were not emphasized by the Republic incident or any of the other dramas of the high seas in which the wireless has had part. One of the newly disclosed needs, quickly reflected by legislation introduced in Congress, was for a continuous wireless service on shipboard,—that is, the employment on each passenger carrying ship of a sufficient number of wireless operators to enable one operator to be on duty at all times to give and respond to warning messages and appeals for help. There is also demand for the installation on ocean liners of more powerful wireless apparatus, having a greater radius of communication than obtains in the case of some of the wireless sets now in service. And, finally, there is much

insistence upon an auxiliary electric power supply, independent of the ship's main electric power plant.

This latter emergency equipment would, naturally, find one of its chief functions in supplying current for the wireless, but there are other considerations which make it desirable for each ship to have surplus electrical resources. The danger of panic, the problems of distributing life belts, the loading of life boats and every other incident of an accident at sea is intensified or complicated if the electric lights are cut off. One of the requirements, then, that has grown out of the Titanic's last moments of darkness is for an auxiliary plant that will supply current for lighting after the regular plant has been put out of commission from any cause, or the operatives have been driven from their posts by fire or by water entering the compartment containing the electrical machinery.

Yet another increased dependency upon electricity is for better and more comprehensive alarm systems on shipboard. It seems to be pretty well established by the evidence that in the Titanic disaster many persons were lost —or, at least, never had a chance for their lives —because no effective general alarm was sounded. Although some of the large trans-Atlantic liners have rather comprehensive alarm systems none of them have installations as elaborate or as efficient as those to be found on our most modern battleships, and which might be copied in some respects most advantageously. The time will probably come when every stateroom aboard ship will be provided with an alarm bell which can be sounded from a common point and which may be used to arouse passengers at night, just as such alarm bells are placed in many modern hotel rooms to enable the sounding of "early rising" calls from the hotel office in accordance with the requests of guests.

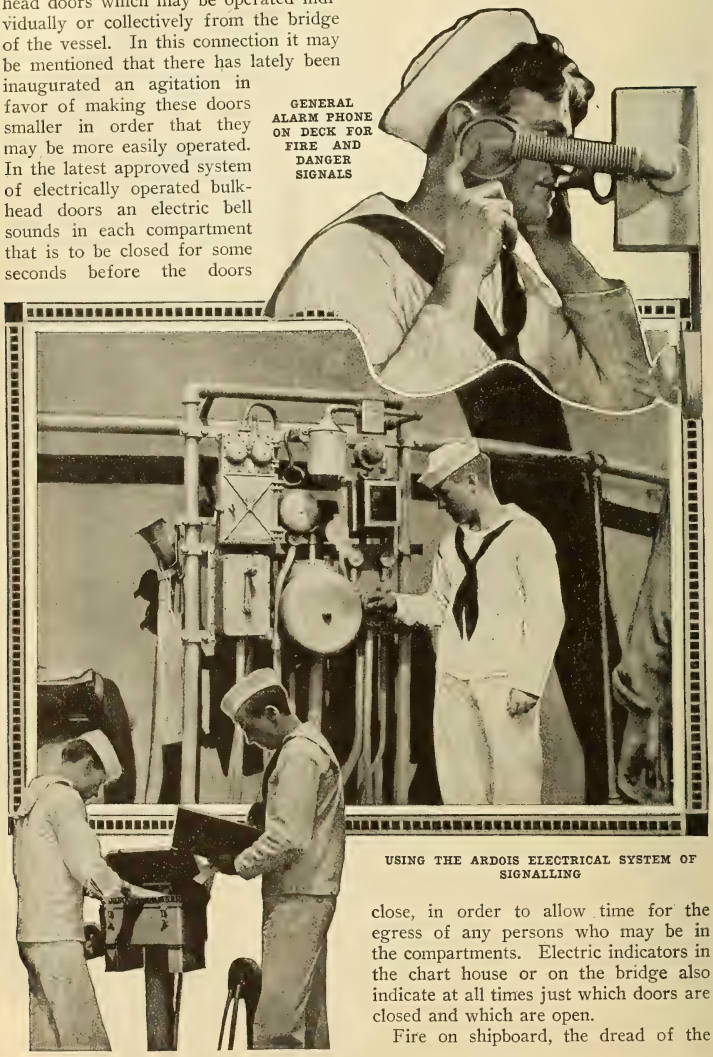
Of the services performed by electricity incident to safeguarding life at sea, there is none more important, perhaps,



ABOVE IS SHOWN THE ELECTRICALLY ILLUMINATED LIFE BUOY READY TO BE RELEASED. BELOW IS THE ELECTRICAL SIGNALLING APPARATUS FOR COMMUNICATING BETWEEN WHEEL AND ENGINE ROOM.

than the operation of the watertight bulkhead doors which may be operated individually or collectively from the bridge of the vessel. In this connection it may be mentioned that there has lately been inaugurated an agitation in favor of making these doors smaller in order that they may be more easily operated. In the latest approved system of electrically operated bulkhead doors an electric bell sounds in each compartment that is to be closed for some seconds before the doors close, in order to allow time for the egress of any persons who may be in the compartments. Electric indicators in the chart house or on the bridge also indicate at all times just which doors are closed and which are open.

GENERAL ALARM PHONE ON DECK FOR FIRE AND DANGER SIGNALS



USING THE ARDOIS ELECTRICAL SYSTEM OF SIGNALLING

Fire on shipboard, the dread of the

oldtime mariner, has been robbed of its terrors in a dual sense by the introduction of electricity. For one thing, the use of electricity for illuminating purposes aboard all vessels of any pretensions has greatly decreased the danger from fire. Secondly, fire, if it does occur, is much more quickly detected and more effectually combated, thanks to the magic current. In all parts of the modern ship are located electric thermostats which, when the temperature rises to a point that indicates the presence of fire, automatically sound electric fire alarms and summon the crew from their quarters. Electric fans likewise play their part in preventing fires by aiding in the ventilation of the coal bunkers, thus reducing the danger of spontaneous combustion, etc.

Supplementing the wireless as a means of communication are a number of other electrical signalling systems which are valuable for the interchange of messages at comparatively close range. Most of these are designed for use at night, and they include the semaphore, the electric torch, which makes use of the wig-wag system; the Ardois system, and the electric "blinker" light.

The interior telephone system of the modern ship is an important adjunct of safe navigation, but it may be remarked that the telephones on shipboard are a very different proposition from those with which the average "land lubber" is familiar, since it is necessary to provide on vessels instruments that will transmit and deliver an exceptional volume of sound, owing to the amount of noise (of machinery in operation, etc.) which must be overcome.

Engine room and other telegraphs which annihilate the distance between the bridge and the power plant in the bowels of the ship are likewise important assets in behalf of the cause of safety at sea. Electricity is now utilized to release the life buoys which are cast into the sea when the cry "man overboard" is heard —it being possible under present arrangements to release four or six such buoys simultaneously from the bridge—and it is predicted that the time will come when electricity will also be depended upon to a considerable extent for the launching of life boats. This important task is, under present conditions, dependent largely upon the human equation, and the human equation is always uncertain in an emergency, so that this constitutes to some extent the weakest link in the chain of marine safeguards. Also, if inventive genius in the field of electrical science could but provide a means of exploring fogs and of indicating the proximity of icebergs, the goal of safety at sea would seem to have been reached.

Extremes Meet in the Antipodes

An American lady residing in Manila, P. I., sent her Waverley victoria-phaeton up to Montalban, Province of Rizal, Luzon, for her own use during a fort-

TWO ELECTRICS IN THE PROVINCE OF RIZAL, LUZON

night's visit at that beautiful mountain resort.

Going for a drive with a friend the day after her arrival, she was surprised and interested to meet another Silent Waverley on a beautiful mountain roadway near the town. On investigation it proved to be a model 60 Waverley surrey, selected by its owner for the sake of its solid construction and large seating capacity.

Hospital Signal Systems

Those engaged in the care of the sick know that prompt response to sudden calls is imperative. In this field electricity has been made to do service by means of signal systems which keep doctors, internes, and nurses in touch with each other and with the patients.

while the drop which shows where he was goes back to place. Should this physician be needed, a nurse telephones the operator, who then calls the doctor.

The doctor may be called also in another way. The nurse presses the button under his name in the nearest button plate in the corridor. This causes the doctor's lamp to light in each lamp an-

HOSPITAL SIGNAL SYSTEM

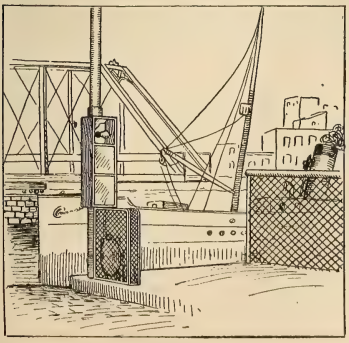
The illustrations show how some of the Holtzer-Cabot hospital signal apparatus operates. A doctor, about to enter a ward, will, in passing a button plate, press his button. This causes a drop on the annunciator at the telephone operator's desk to fall, showing where he is, nunciator in every corridor of the hospital, and the doctor's drop falls on the telephone operator's board, indicating the point where he is needed. The doctor, noting that the lamp indicator has a call for him, telephones the operator and is told where to go.

Should a patient wish to call the nurse, he presses a calling button on the end of a cord from a wall plate to his bed. A drop corresponding to it shows on the nurses' annunciator, the semaphore outside the door of that particular ward or room drops into an exposed position, and the lamp on it lights up. A bell on the nurses' annunciator also rings as long as the patient is pressing the calling button. The semaphore outside the door remains down and the drop in the annunciator exposed, until the nurse answering the call arrives at the door of the ward or room. She pulls the chain and resets the semaphore. At the bedside of the patient she pushes the resetting button, and this restores the drop in the nurses' annunciator and puts out the light.

A Combination Danger Signal

Numerous accidents, resulting in loss of life, have occurred at swing and draw bridges, during the past few years, chiefly owing to the high rate of speed at which automobiles may be driven and with a consequent inability to stop within the necessary distance to prevent the car from plunging to destruction over the abutments.

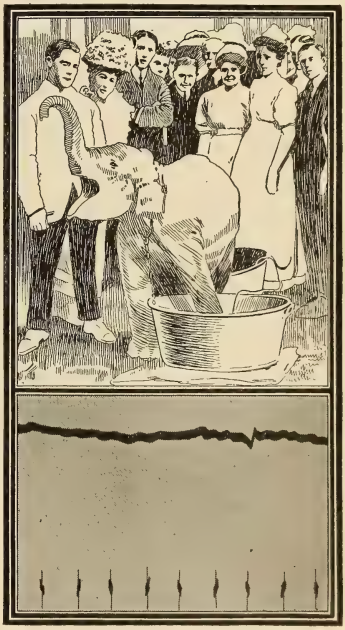
In addition to policemen stationed at its bridges, Chicago has installed a series of red lights and a loud sounding electric bell. Both of these signals operate when the bridge is opened, so that two of the senses, seeing and hearing, are warned of danger when the driver is approaching draw.



DRAWBRIDGE SIGNAL

Baby Jumbo's Heart Beats

"Baby Jumbo," a young elephant owned by an enterprising London newspaper, recently had his heart beats recorded at a hospital. He placed two feet in basins of salt water in which were the terminals of an electric circuit so connected as to make possible a graphic record of the pulsations of his circulatory system. A record of one of the experiments is shown in the lower picture by the wavy line.



HAVING HIS HEART BEATS RECORDED

The Ideal Insulator

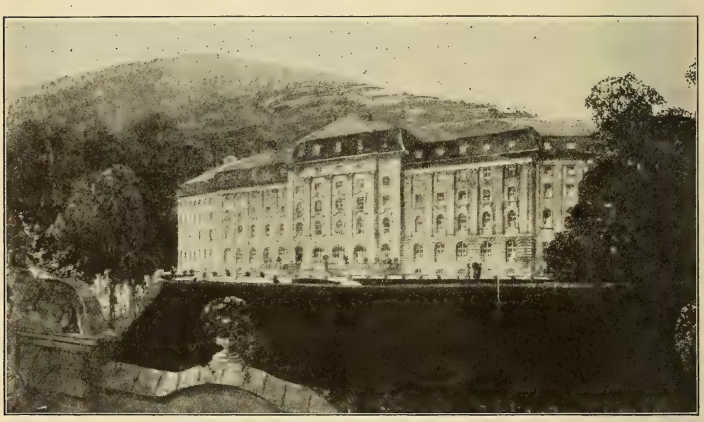
The highest electrical conductivity has hitherto been found always associated with the greatest purity of such metals as copper, silver, aluminum, and iron. These metals are ductile, easily worked, and also conduct heat well. Soft copper, where its tensile stress is not excessive, as in dynamo construction, is also a valuable conductor. In the case of exposed wires, however, it is necessary to use hard drawn copper, even at a loss of two per cent in electric conductivity.

Insulating materials which are enduring, resistant to exposure, strong and available for manipulation, are rare. Glass is too brittle for heat, cold, and mechanical stresses. The properties of insulators really indicate that electrons have difficulty in jumping from atom to atom. Unfortunately, this often is a concomitant of brittleness. This same defect of handling electrons from one atom to another explains why most insulators are heat conductors. This shows a remarkable similarity between substances classified as thermally and electrically conductive.

It is not yet known upon what conditions within a material its insulating capability depends. Both physical and chemical changes play a part in the making of insulators. It is therefore within the realms of reason to expect some time an insulator that will be durable, unweatherable, noncombustible, elastic, pliable, workable, germ proof, moisture proof, thermal proof and cheap.—Dr. Leonard Keene Hirschberg.

Hotel for Radium Bathers

St. Joachimsthal, the radium town of the world, in northwestern Bohemia, became famous soon after the discovery of this mineral by Professor and Madame Curie. Immediately following the knowledge of the curative properties of radium, a large hotel-sanatorium, here shown, was built in the town. The building is capable of housing 400 people, while an annex containing 50 rooms provides additional accommodations. Every means for bathing in the radium carrying waters is afforded, which, with the elevation of 2,100 feet above the sea level, makes it a much sought resort. The sanatorium rooms are provided with hot and cold water and a telephone. There

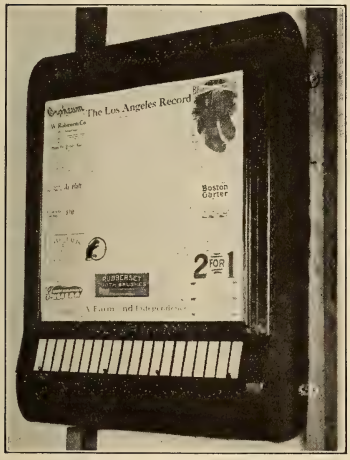


HOTEL IN ST. JOACHIMSTHAL, THE RADIUM TOWN

is an open air dining room, a billiard parlor, music room, reading and writing room, winter flower garden, stenographers to care for correspondence, and postoffice and telegraph facilities.

The Electrical Directory

A street corner directory which operates by electricity is the invention of a Los Angeles man, who expects to place it on the busiest corners of the city and in hotels and railroad stations. The device looks like a large letter box,



STREET CORNER DIRECTORY

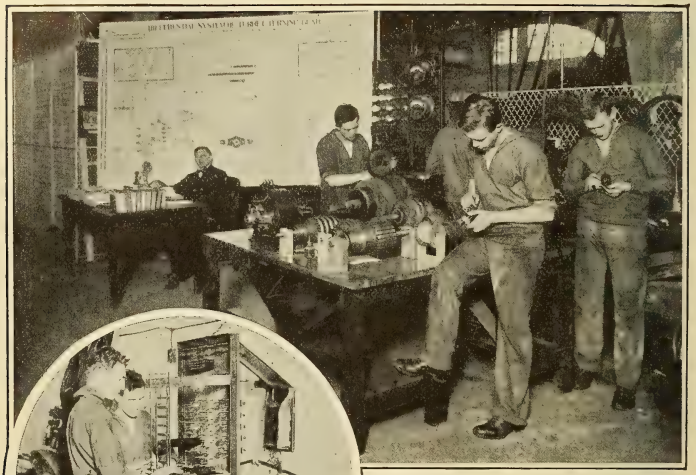
is of metal and is 34 inches high, 24 inches wide and ten inches deep. A square of glass measuring 21 inches is set in the front of the box, and behind it is displayed a tape of equal width on which is printed a business directory. The tape is reeled on drums above and below the glass and is divided into 21 sections, each containing a list of all the firms engaged in certain lines of business. A row of push buttons on the lower part of the device is labeled with a corresponding list, as, "dry goods," "groceries," etc., and by pressing one of these buttons the reels unwind until the desired section is brought into view. Current from the commercial lines is used for operating and lighting the device.

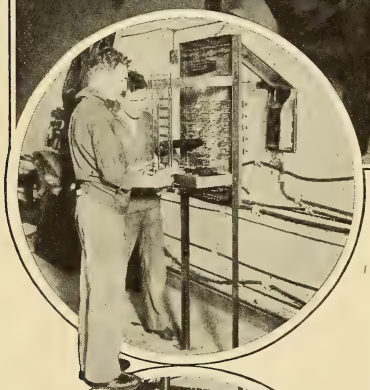
Besides a complete business directory (in which names are inserted free), there is space for display advertising, and this will pay cost of operation and the owner's profit, as each machine contains 8,800 square inches which should sell at a good price to local merchants. In addition to the regular directory feature, the device will give information of value to tourists and strangers in the city, regarding car lines, amusements, hotels, etc. No charge will be made to the public for its use.

Mine Mules and the Trolley Wire

Mine locomotives ordinarily operate at 250 or 550 volts on the trolley system, the rail being used as the return circuit. The trolley wire is strung well to one side of the entry (usually several inches outside the rail) in order to safeguard the passers-by. In many cases the entries are not more than six feet high, sometimes less than that, and a 500 volt trolley wire is not a comfortable thing to have near one's head in a dimly lighted passage with a very uneven floor, especially when rapid movement is occasionally required in dodging passing cars.

Mules, which in some mines are used for "gathering" (drawing the loaded cars from the rooms to the electric haulage track), are very sensitive to electric shock and in low entries their long ears are a source of annoyance; to the mules for obvious reasons and to the mine owner because a good mule costs over $200. When mules are worked around an overhead trolley a sort of hood or cap is placed over their long ears and tied down on their necks so as to reduce to a minimum the chances for contact with the electric circuit. A mule that has received an electric shock is (if he survives) very restive near the trolley wire and uses all his intelligence to avoid it.



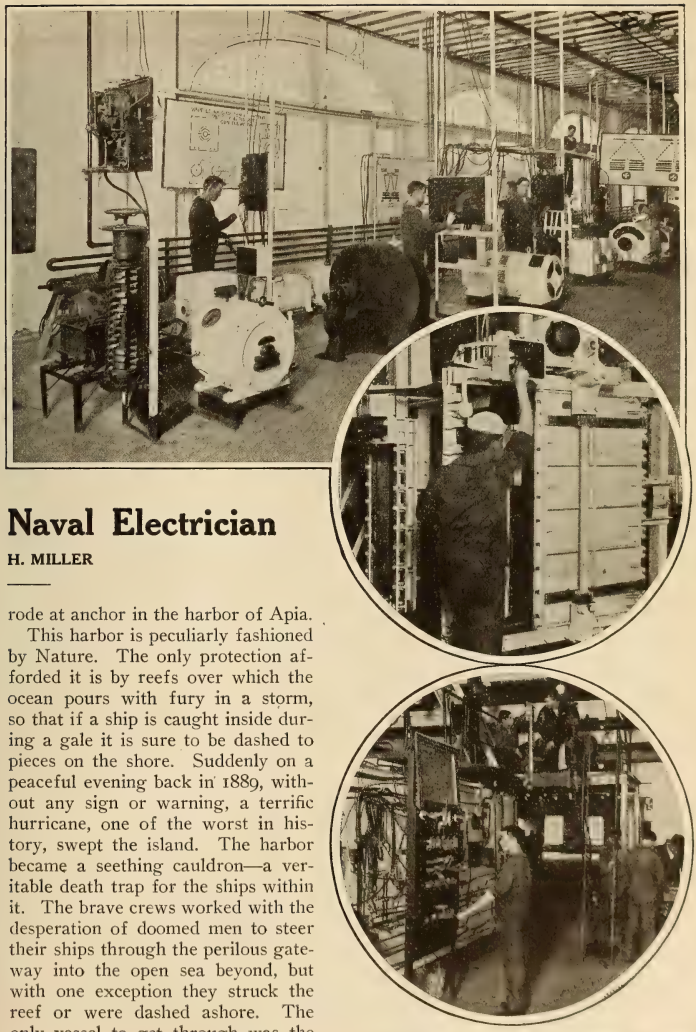


WINDING ARMATURES AND OTHER EXPERIMENTAL WORK IN THE BROOKLYN NAVY YARD SCHOOL

The Making of the

By ARTHUR

It was away back in 1885 that electricity was first made use of in the American Navy. Rear Admiral Royal Bird Bradford, who may be said to be the father of electricity in our Navy, was then a lieutenant-commander. Under his direct supervision the first dynamo ever used in the Navy was installed on board the ill-fated old Trenton, a square rigged steam frigate. This dynamo supplied the current for the ship's lights and for a primitive sort of a searchlight, the first in the Navy. The tragic end of the Trenton came in 1889 in the harbor of Apia, Samoa. The Trenton and two sloops-of-war, the Vandalia and the Nipsic, were sent by the government to Samoa to settle a territorial dispute that had arisen there. Germany and Great Britain also sent ships, so that the pride of the strongest navies of the world



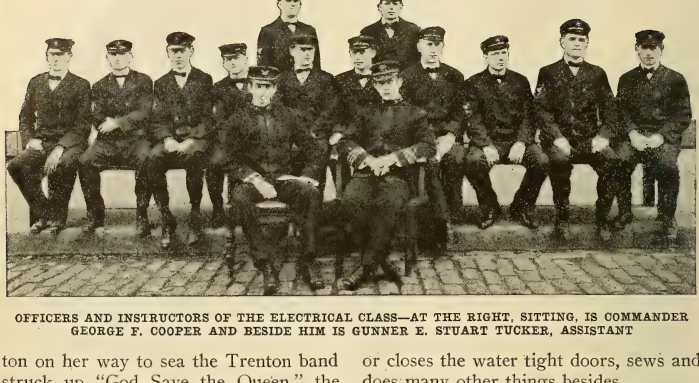
MANIPULATING THE TURRET TURNING, WATER TIGHT DOOR AND SIGNAL APPARATUS

Naval Electrician

H. MILLER

rode at anchor in the harbor of Apia.

This harbor is peculiarly fashioned by Nature. The only protection afforded it is by reefs over which the ocean pours with fury in a storm, so that if a ship is caught inside during a gale it is sure to be dashed to pieces on the shore. Suddenly on a peaceful evening back in 1889, without any sign or warning, a terrific hurricane, one of the worst in history, swept the island. The harbor became a seething cauldron—a veritable death trap for the ships within it. The brave crews worked with the desperation of doomed men to steer their ships through the perilous gateway into the open sea beyond, but with one exception they struck the reef or were dashed ashore. The only vessel to get through was the British sloop-of-war Calliope, and as she passed the floundering Tren-



OFFICERS AND INSTRUCTORS OF THE ELECTRICAL CLASS—AT THE RIGHT, SITTING, IS COMMANDER GEORGE F. COOPER AND BESIDE HIM IS GUNNER E. STUART TUCKER, ASSISTANT

ton on her way to sea the Trenton band struck up "God Save the Queen," the Calliope's band replying with "Star Spangled Banner." The sailors of both ships manned the rails and cheered. The Trenton and the Vandalia were wrecked on the reef and the Nipsic went ashore.

Rear Admiral Bradford was made Chief of the Bureau of Equipment in 1897, and he bent his best efforts toward opening up the wonderful future he saw for electricity in the Navy. Up to that time there were no electricians in the Navy. Electricity was used on some of the ships, but was considered more of a luxury than a necessity. Dynamos were then operated by gunners' mates, who were graduates of the seaman gunner's class.

In 1898 Assistant Secretary of the Navy Theodore Roosevelt issued a general order creating a rating for electricians and in the same year the electrical school, at the Brooklyn Navy Yard, had its inception. It now ranks as one of the leading institutions of its kind in the world. The demand for electricians in the Navy has increased so rapidly that it is all the school can do to meet it. On the modern battleship electricity swings the great turrets, lights the entire vessel, including the searchlights and Ardois signals, operates the wireless, does the ventilating, runs the pumps, cooks, opens or closes the water tight doors, sews and does many other things besides.

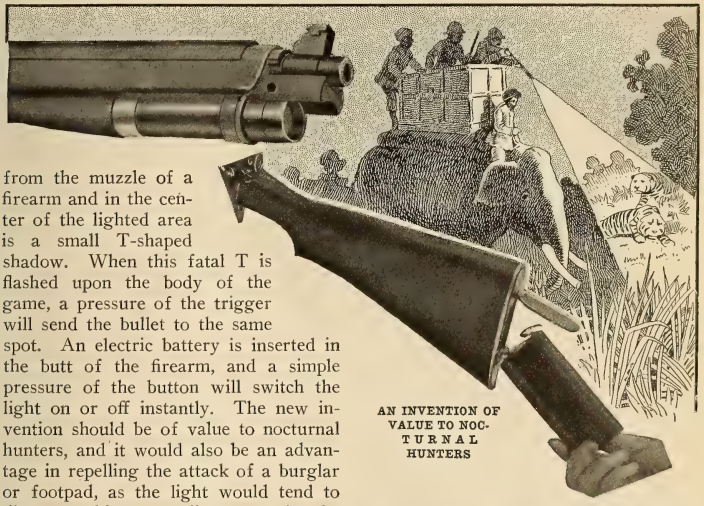
The electrical generating apparatus of the ships which last October assembled in the Hudson River had a combined power of 19,470,000 watts or 26,000 horsepower, which is capable of lifting 429,000 tons a foot a minute. In other words, it can lift all at once fourteen superdreadnaughts, such as the Florida, over the Metropolitan tower in less than twelve hours. These figures are based on an estimate compiled by a prominent Navy official who was present at that greatest mobilization of battleships in the history of the world.

The generating apparatus of the various ships varies, of course, very greatly with the size of the vessels. The superdreadnaughts carry an equipment of four 300 kilowatt generators, equivalent to upwards of 1,608 horsepower. This is in addition to the emergency apparatus. In the crews of these latest terrors of the deep are from 35 to 40 skilled electricians.

Supervising and operating all this electrical machinery requires skill of a high order and the teaching in the naval schools must be thorough. The pictures herewith are calculated to show the kind of practical work which an electrician of the Navy must go through with before he is fitted to take his place.

A Searchlight for the Rifle

A searchlight which enables a marksman to aim accurately at night has been devised by an Englishman, Mr. Morrison Bourke. It consists of a flashlight which sends a bright pencil of illumination from the muzzle of a firearm and in the center of the lighted area is a small T-shaped shadow. When this fatal T is flashed upon the body of the game, a pressure of the trigger will send the bullet to the same spot. An electric battery is inserted in the butt of the firearm, and a simple pressure of the button will switch the light on or off instantly. The new invention should be of value to nocturnal hunters, and it would also be an advantage in repelling the attack of a burglar or footpad, as the light would tend to disconcert him, as well as to make the aim quite certain.



AN INVENTION OF VALUE TO NOCTURNAL HUNTERS

The device, as noted in the picture, is very compact and does not interfere in the least with the operation or cleaning of the weapon.

Coal Mines Turned Into Gas Retorts

At the opening of the Smoke Abatement Exhibition in London last spring, Sir William Ramsay referred to the ideal state of things that would exist if we had gas retorts in the mines, adding that there was nothing, so far as he could see, to prevent a borehole from being put down until the coal substratum was reached, concentric tubes being used to set the coal on fire by electricity. Air would be blown down to enable the coal to burn as a preliminary operation. Sir William elaborated his idea thus: "When sufficient heat has been engendered, the amount of air sent down can be restricted. Coal with plenty of air gives carbon dioxide. When partially burned it gives carbon monoxide, which is used for gas engines. If steam were blown in, it would give a mixture of hydrogen and carbonic oxide, or water gas, which also is used frequently in gas engines.

"Bring gas engines to the mouth of your pit or borehole, and produce your power there. You would thus save 30 per cent of the energy of the coal available, as against 15 per cent available in fuel engines.

"That energy might be transformed into electricity at the mouth of the borehole and you could distribute it throughout the country, wherever you like. In this way you would get electricity available for lighting and heating, your railways would be worked by electricity, and the only fuel you would require would be oil for ships."

Rules Recommended by Resuscitation Committee

Following are the rules which have been recommended by the Commission on Resuscitation from Electric Shock representing the American Medical Association, the National Electric Light Association and the American Institute of Electrical Engineers:

FOLLOW THESE INSTRUCTIONS EVEN IF VICTIM APPEARS DEAD

I. IMMEDIATELY BREAK THE CIRCUIT

With a single quick motion, free the victim from the current. Use any *dry non-conductor* (clothing, rope, board) to move either the victim or the wire. Beware of using metal or any moist material. While freeing the victim from the live conductor have every effort also made to shut off the current quickly.

FIGURE 1—INSPIRATION; PRESSURE OFF

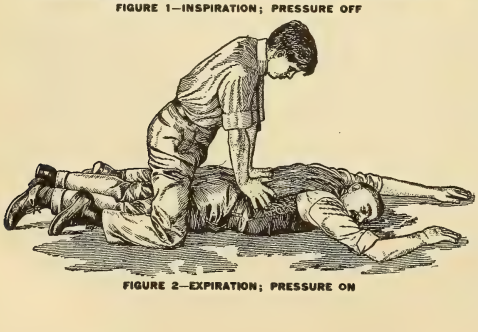


FIGURE 2—EXPIRATION; PRESSURE ON

II. INSTANTLY ATTEND TO THE VICTIM'S BREATHING

1. As soon as the victim is clear of the conductor, rapidly feel with your finger in his mouth and throat and remove any foreign body (tobacco, false teeth, etc.). Then *begin artificial respiration at once.* Do not stop to loosen the victim's clothing now; *every moment of delay is serious.* Proceed as follows:

(a) Lay the subject on his belly, with arms extended as straight forward as possible and with face to one side, so that nose and mouth are free for breathing (see Fig. 1). Let an assistant draw forward the subject's tongue.

(b) Kneel straddling the subject's thighs, and facing his head; rest the palms of your hands on the loins (on the muscles of the small of the back), with fingers spread over the lowest ribs, as in Fig. 1.

(c) With arms held straight, swing forward slowly so that the weight of your body is gradually, but *not violently,* brought to bear upon the subject (see Fig. 2). This act should take from two to three seconds. Immediately swing backward so as to remove the pressure, thus returning to the position shown in Fig. 1.

(d) Repeat deliberately twelve to fifteen times a minute the swinging forward and back — a complete respiration in four or five seconds.

(e) As soon as this artificial respiration has been started, and while it is being continued, an assistant should loosen any tight clothing about the

subject's neck, chest or waist.

2. Continue the artificial respiration (if necessary, at least an hour), *without interruption,* until natural breathing is restored, or until a physician arrives. If natural breathing stops after being restored, use artificial respiration again.

3. *Do not give any liquid by mouth until the subject is fully conscious.*

4. Give the subject fresh air, but keep him warm.

III. SEND FOR NEAREST DOCTOR AS SOON AS ACCIDENT IS DISCOVERED

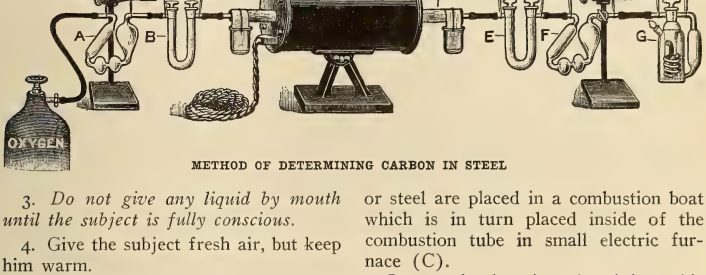
The Great Proctor Theater Sign In New York

At Proctor's One Hundred and Twenty-fifth Theatre, in New York, the Fourth of July was celebrated by the lighting of one of the largest electric theatre signs in the world, the same being a gigantic "P" with the letters of the word "Proctor" running down the stem. The total height of the sign is 90 feet and the height over the roof is 67 feet, with the width over the roof, 30 feet.

For those technically inclined it may be added that the sign required 50,000 feet of circuit wires to connect 262 separate circuits. Four thousand lamps and fifteen tons of iron were used in the construction, the letters inside the stem of the "P" being four feet six inches high. The cost of the whole affair was over $10,000, and the sign can be seen for many miles around in Jersey, the Bronx and Long Island.

Combustion Train Determines Carbon in Steel

A modern apparatus is here shown as used in steel works laboratories for the determination of the amount of carbon in steel. Drillings from samples of iron



METHOD OF DETERMINING CARBON IN STEEL

or steel are placed in a combustion boat which is in turn placed inside of the combustion tube in small electric furnace (C).

Oxygen is then introduced into this tube, having been first purified by running through the bulbs (A) and (B), which contain caustic potash solution for removing carbon dioxide and calcium chloride for the purpose of absorbing all moisture.

The temperature maintained in the furnace is about 1,750° F. The steel drillings are burned in the oxygen and the carbon uniting with the oxygen forms carbon dioxide (CO_2).

As the gas emerges from the tube it passes through some granulated zinc into tube (E) where traces of sulphur are removed; then through bulb (F), which is filled with sulphuric acid to remove moisture. Tube (G) is a specially designed double bulb filled with granulated caustic potash on the inside and caustic potash solution on the outside. This caustic potash absorbs all of the carbon dioxide.

The bulb having been formerly weighed is now weighed again and by calculating the weight of the sample and the difference in weight of the bulb before and after the combustion, the amount of carbon in the steel is determined.

Bringing Water to New York from the Catskills

By EDWARD LYELL FOX

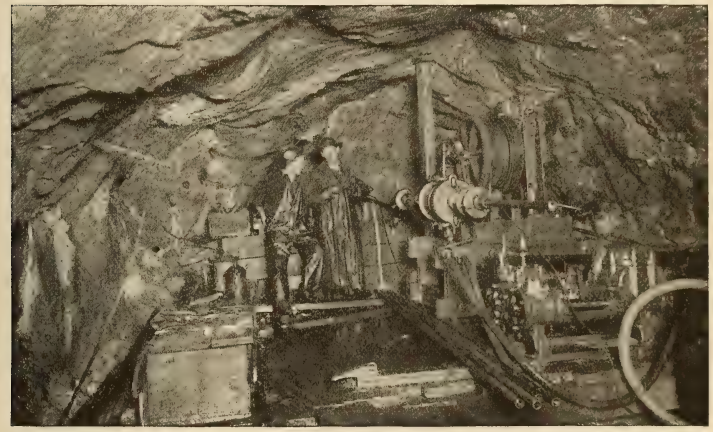
Under the very feet of the city, hundreds of feet below the pavement, through solid rock the great tube is boring its way; nearly eighteen miles from a point beyond the city limits, down through the outlying borough of the Bronx, under the Harlem River, through the maze of subways and sewers in Manhattan and thence under the East River to Brooklyn—an engineering feat the like of which has never been attempted before. And it's going to cost $25,000,000 before the water from the new Catskills sheds goes churning through it—pure, wholesome water from the mountains, 500,000,000 gallons a day, that New York must have to drink. But consider now that this great project is possible only because of electricity.

As an engineering proposition it would be impossible were it necessary to use steam engines, steam pipe or compressed air lines instead of the electro-pneumatic apparatus and other mechanical appliances driven by electric power. The limited space, the demand for speed, the necessity of compactness make it imperative that the smaller yet more efficient electrical apparatus be used. And for the same reasons the great tunnel must be lighted by electricity by thousands of tiny bulbs that burn steadily and brightly. These are not my opinions, they are the opinions of engineers.

MAYOR GAYNOR OF NEW YORK TOUCHING THE SWITCH WHICH WILL BLAST THE REMAINING SECTION OF ROCK BETWEEN THE EAST AND WEST HEADINGS OF THE HUDSON RIVER DIVISION. WITH HIM ARE COMMISSIONERS CHADWICK, GALVIN AND STRAUSS, AND POLICE COMMISSIONER WALDO.

The passerby at Broadway and Twenty-fourth Street, noticing temporary small buildings of rough wood, remarks casually: "Tearing up the streets again"—and walks on. For days I passed this same place, said about the same thing—if I happened to be with anybody—and walked on. Then came a day when a young engineer was my companion and as the planking reared into sight above the pavements he asked: "Been over there?"

dampness growing about us, unpleasant odors thickening, and a faint rumbling becoming more and more sonorous. Then we stepped from a ladder into what appeared to be a shelf in the rock and saw below us the confusion of tunnel building. And what confusion it appeared at first sight! Men lurched through the darkness, bending their heavy bodies to the weight of tools and apparatus. Over them lights burned balefully, casting an unhealthy yellow



A SOUND GATHERED HARSHLY INTO THE CLATTER OF DRILLS—THE SNARLING CONTACT OF STEEL ON ROCK

Upon being answered in the negative, he said:

"Well, it's time you went. Come on!"

Later he was dumfounded to learn that I didn't know the rough structures to be the head of one of the most important shafts along the line of the tunnel. At a gate in the tall fence he met another engineer, a friend luckily, and our descent into the tunnel was arranged.

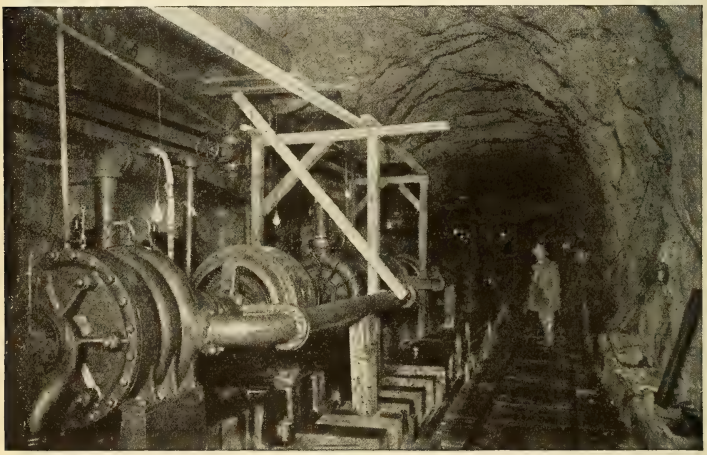
I've never been down into a mine but my guide saying the shaft was like one he used to enter in Idaho, I believed him. You could have believed anything of that place. Down, down we went, the

glow on their heavy features. Like specters of another world they passed, silhouetted a moment against the yellowish glare, darkening into shadow and vanishing.

We moved along the ledge and behind an overhanging rock. I noticed the strings of wires about me, bearing light from one end of the job to the other. My companion told me that the regular city power was tapped by every job. Then I saw two rows of rails, yellow, too, in that uncanny light, cast down among the shadows, like worms spread out on their backs. And from afar there came

a rattling, a sound of wheels turning, of men breathing heavily and stumbling. Then more "muckers" appeared, lurching along like the dripping car they were pushing.

The engineer beckoned; I followed him further along the ledge, walking until it seemed as if the air was growing darker, the light dimmer. I touched my forehead—it was damp like the rocks beside the men. And as we walked, a impudent jingle in that clamor. Then a foreman hastened to a wooden post, jerking down the receiver from a telephone. Blocks away at the other end of the job another foreman was calling him and for a minute they talked, deciding something about the work, that had there been no telephone might have wasted fully half an hour by trips back and forth. Then my friend called attention to the electric pumps, stiff with the



ELECTRIC PUMPS, STIFF WITH THE POTENTIALITY OF POWER, WAITING IN THE SHADOW FOR A MOMENT OF NEED

sound, faintly audible at first, gathered harshly into the clatter of drills—the snarling contact of steel and rock.

Then I learned that the drills were electro-pneumatic and that the tangle of pipes were the feeds that came from an apparatus above. But as we stood watching the drillers, I noticed that there was a certain orderliness to the confusion. Each vague form was performing his task—mucker, driller, Boss—was but a unit in the unseen machine that untiringly, relentlessly was eating its way through eighteen miles of rock.

Suddenly there sounded about the confusion of it all the jingle of a bell—an potentiality of power, waiting in the shadows for a moment of need.

There are 24 of these shafts strung along the path of the bore—the eighteen mile path from above the city limits to the borough of Brooklyn. And all of them are vibrating with the power of the electric current. For the most part they're in the public parks—St. Nicholas, Morningside, Central, Bryant, Fort Green—that the route passes under, and at street intersections. As the park drives are lighted by electricity, the supply is available there, too. From the bottom of these shafts, the sections of the tunnel are being driven in two direc-

tions. Thus the sections from adjacent shafts upon meeting will form the continuous tunnel, that will bring a river of drinking water through to New York daily.

"No doubt," my companion began, "you noticed the completion of the tunnel under the Hudson River above West Point. It is 1,100 feet below sea level and was the last physical difficulty between the Ashokan reservoir and the city line at Yonkers. At Yonkers the water is held by the Hill View reservoir. This, a distributing station 295 feet above sea level, will feed the tunnel that we just left."

Now let us see some of the problems that had to be overcome before a stroke of work was done and the peril that daily menaces the workers, sometimes 200, sometimes 700 feet underground.

"When the problem of how to distribute Catskill's daily supply of 500,000,000 gallons of water first came up," one of the general superintendent's engineers told me, "the ways of solution were seen to be only two. One was to carry the supply in metal pipes laid in the streets close to the surface; the other was to build a tunnel through rock. The cost of the first plan was tremendous. Incidentally it would have made little use of electrical apparatus. It was estimated at $47,000,000. Thirty-two 48 inch pipes or sixteen 66 inch pipes would have been necessary to transport the daily flow and deliver it at the desired elevations.

"On the other hand the tunnel plan was estimated to cost $10,224,000. That was in 1905. Since that another estimate was made placing the expenditure at $25,000,000. This is not a great price to pay when one considers that the tunnel will distribute half a billion gallons of water a day in the simplest and safest manner that man has ever devised. The tunnel, about large enough to permit a subway train to pass through it, is being excavated at from sixteen to eighteen feet in diameter. Being lined all around by a foot of concrete, however, the finished bore will be on the average two feet less. Located from 200 to 740 feet below the street level, the tunnel will be lower than any subway, even tiers of subways, that New York may build. The principal reason for this great depth is that the engineers wanted to bore through solid rock. They figured it easy with electrical apparatus. All sewers, gas, water mains, ducts and other tunnels will always be above it. It is all very easy when you consider it as one great plan.

Mayor of Wheeling in His Decorated Electric

Mayor Charles C. Schmidt, of Wheeling, W. Va., was in a recent floral parade in his home town. The decorated automobile in which he is seated is a Silent Waverley Electric.

MAYOR IN A DECORATED ELECTRIC AUTO

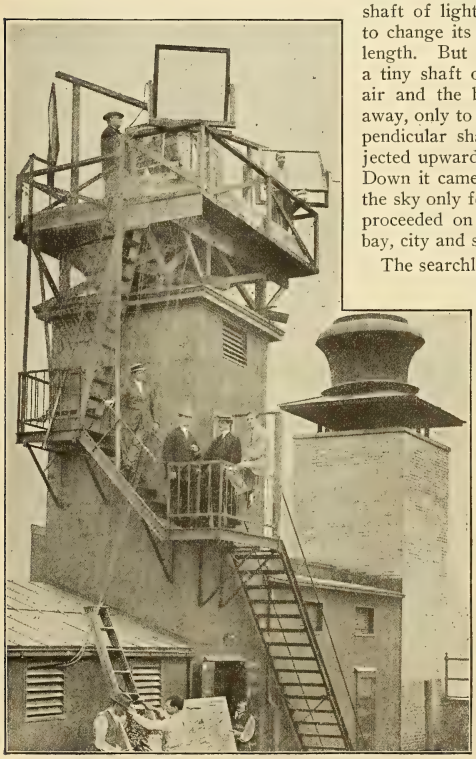
Though the Mayor is an aggressive figure in the local politics of his community, it will be seen that his natural instincts incline to peace, since the dove of peace is the principal emblem on the car.

Novel Searchlight Advertising in Baltimore

National Democratic Convention visitors and all Baltimoreans out on the street after dark were familiar with the brilliant, startling, ever-changing searchlight effects, in white light and in color, that were flashed nightly from the top of the new Fidelity Building.

In these novel effects first came the huge majestic fantailed beam of pure white light that flashed out over Baltimore city, the bay and the distant suburbs. With movement for all the world like the arm of an immense giant, this big solid white beam radiated outward and, with the Fidelity Building as a centre, marked, once a minute, its wonder-circle about the city.

Then something happened. Suddenly the big beam was seen to change as it swept along. Now it quivered with the rapidly changing, vibrating color. Red and green, orange, pink and yellow and back again to white. All these had their turn and still the big beam swept on. But this was not all. Again, the great shaft of light was seen, chameleon-like, to change its color throughout its entire length. But this time it broke in two, a tiny shaft of light darted up into the air and the big horizontal beam faded away, only to be replaced by a great perpendicular shaft of changing light projected upward into the sky at the zenith. Down it came again. It had been up in the sky only for an instant, when it again proceeded on its long journey over the bay, city and suburbs.



SEARCHLIGHT WITH NOVEL PROJECTOR

The searchlight proper which had been courteously placed at the disposal of The Fidelity Trust Company of Baltimore by the Consolidated Gas, Electric Light & Power Company, was mounted as shown in the picture in the center of a supporting platform. This platform surmounted one of the elevator houses on top of the building. The searchlight thus found a setting on one of the highest points in Baltimore.

The apparatus in its entirety consisted of the supporting platform, the searchlight proper, a motor in the base of the searchlight for revolving it, four large light oscillators, or projectors, and the coloring apparatus.

The searchlight proper had a diameter of 24 inches, i. e., it threw a beam of light 24 inches in diameter. The motor in the base of the searchlight was run by the same source of current that fed the light. But it was started and stopped without in any way interfering with the light itself. The angle of the beam of light was easily adjusted by hand and the lamp locked into position by a thumb nut.

A glance at the picture will reveal that the projectors are located one at each of the four corners of the platform railing. Each projector, or oscillator, is carried by a supporting frame of peculiar construction. These frames are so built that any one or all of the four projector oscillators may be set at any angle desired relative to the beam of light. Or, any or all the oscillators may be revolved on the bearings and at the same instant be swung about.

Directly over the center of the searchlight is hung the horizontally revolving color mechanism. This device produces and varies the four colors in the beam.

Assume, for instance, that the searchlight makes one turn, horizontally, about the horizon per minute and that the projectors are set stationary and at a right angle. With the apparatus thus arranged the big white beam would first sweep along horizontally until it struck the first projector-oscillator. It would now begin to split and part of the beam would dart up perpendicularly into the sky. In a moment the entire beam would be, literally, "up in the air." Then a portion splits off and darts out horizontally, only to be followed in an instant by the full white beam, which then proceeds on its way to the next projector.

With the searchlight thus working automatically in connection with the inclined projectors, the operator now rotates his color mechanism. Instantly the beam, whether horizontal, split or perpendicular, becomes alive with scintillating varying color.

Further, if the operator so desires, any or all of the projectors may be oscillated so as to throw the beam, as it travels over them, backwards and forwards across the heavens; or any projector may be rotated with the searchlight stationary so as to throw or swing beam after beam, so to speak, in quick succession across the sky and down on to buildings, etc. Or the beam, filled with one color or full of scintillating color, may be turned on to the street to illuminate processions, floats, etc.

This novel searchlight apparatus was designed by Frank L. Perry, of the executive staff of the Fidelity Trust Company.

An Insidious Loss that Invites Attack

"The whole electrical industry is now tied to the silicon-iron alloy." So remarked Mr. W. R. Whitney in an address before the National Electric Light Association. "The highest grade transformers make use of an alloy of about four per cent silicon. Silicon itself is derived from the reduction of sand by carbon in an electric furnace and is now made in large quantities at Niagara Falls. Its effect on iron is to greatly increase the resistivity, which in turn reduces that part of the core loss due to eddy currents induced in the iron, and its presence also reduces the energy lost in the magnetic hysteresis.

"If the cores of the transformers sold by the General Electric Company last year had all contained the high grade common iron, as used to be the case, instead of the silicon alloy now largely used, the additional loss, when they were all operating, would correspond to about $15,000 per day at the ten cent rate.

"This insidious type of loss will always be an object of attack by the experimenter, because it seems absolutely unnecessary. No one knows that a magnetic hysteresis *must* exist: we simply know that it *does* exist, and moreover, that it is being continually reduced by discovery. I call it an insidious loss because it is going on all the time and doing no good."

Some Secrets of Electrical Stagecraft

By T. J. NEWLIN

PART V

PRODUCING A RAINBOW BY THE SCIENCE OF OPTICS

The rainbow effect is produced by the laws of optics, so to make it clearer to the average reader I will give a short illustration of how it is accomplished by the rays of light being acted upon by

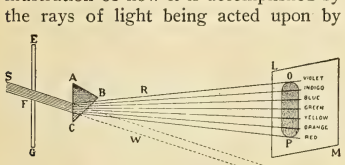


FIG. 25. SEPARATION OF A RAY OF SUNLIGHT INTO THE PRIMARY COLORS BY MEANS OF A PRISM.

lenses interposed in front of the sciopticon, a lamp used on the stage to produce any effect in Nature, such as moving clouds, streaked lightning, moon rise, water ripple, etc.

SEPARATING THE SEVEN COLORS FROM THE WHITE LIGHT OF THE SUN

As almost everyone is aware, all white light contains seven primary colors. By causing white rays of light to pass through a prism they are separated into seven colors, which are known by their position in the spectrum, viz.: red, orange, yellow, green, blue, indigo and violet, as shown in Fig. 25.

Let (S), Fig. 25, be the impinging beam of light and (WT) its path, if not intercepted by the prism (ABC). The beam of light (S) passes through the hole in the shutter (EG) and impinges on, or strikes the prism, which acts the same as a ray of light passing from a rarer to a denser medium and bends the light toward its base, which disperses the light according to the refrangibility of the color, red being bent the least, while the other colors in their respective order are bent to a greater and greater degree until the violet is reached, which undergoes the greatest refraction or bending of all.

On the cardboard (LM), the colors are shown as dispersed by the prism. In other words, the spectrum (OP) is shown with the proper position of the colors. In the sciopticon attachment a slot (S), Fig. 26, is made in the plate in front of the condensing lens (LL_1), allowing the light to emerge through same and strike the prisms (PP_1), which disperses the projected rays upon the back drop on the stage in the form of an encircling rainbow, thereby bringing out the seven colors of the rainbow, or the solar spectrum, apparently true to Nature.

THE WONDERFUL, FASCINATING SCIOPTICON

To my friends, Mr. Joseph Menchen and Messrs. Kleigel Bros., I am indebted for the privilege of using the views of the sciopticon and its various uses. In Fig. 27 are shown two views of one of these sciopticons, with Mr. Menchen holding in his hands a disk that revolves in front of an arc light and carries the

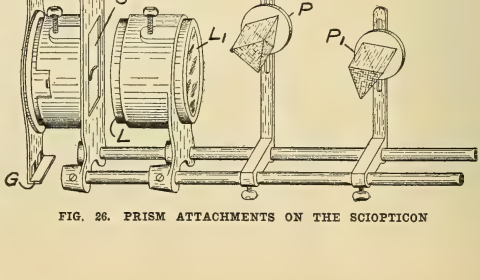


FIG. 26. PRISM ATTACHMENTS ON THE SCIOPTICON

painted scenes which are projected on the stage by means of a battery of lenses. The tortuous wavings and windings in the glass or mica, which are so indented as to cause a jumping up and down of the rays of light while being thrown upon the "drop," cause the fire effect. The plate or disk is usually artistically painted in colors to represent the flames, bending from red to yellow. The particular plate which the operator is holding in his hands is designed to produce the cyclone effect. To remove the disk, all that is necessary is to loosen the thumb nuts. At the right in the picture is shown the operating mechanism, particularly the speed clock (S), which is wound up by a key and is the motive power for all these effects.

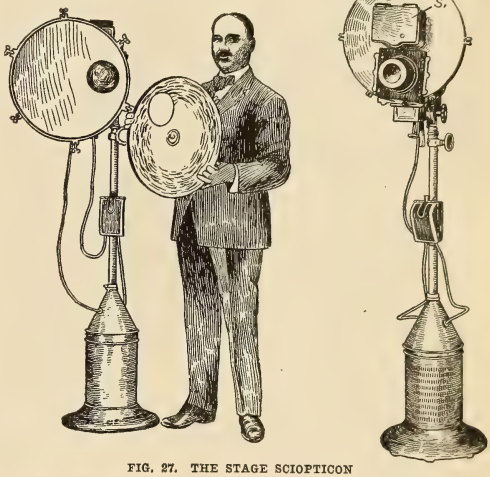


FIG. 27. THE STAGE SCIOPTICON

THE "WOMAN IN THE MOON"

That there is a woman in the moon can be proved by the most natural fact that if there was not the man would not be there. In the illustration, Fig. 28, they both are shown pointing earthward. The instrument below, which has just been described, throws the picture on the screen in the same manner as the magic lantern.

We will now digress for a moment from the strictly theatrical illusions to those of much greater scope which are produced in special buildings set aside for the purpose at expositions, large amusement parks, etc.

"UNDER AND OVER THE SEA"

Figure 29 illustrates the largest type of moving panoramic sciopticon machines ever built. These machines were first built for "Under and Over the Sea," at the World's Fair, St. Louis, and a "Trip to Mars," at the White City, Chicago. They are by far the finest and largest machines in the world today. The same type of machine was used in Mr. Menchen's production of "Hades to Paradise by Airship." The great disk shows the imaginary designs which are supposed to exist in and between the planets. This is used in the new production of "War in the Clouds." The plate in this machine is 60 inches in diameter and the aluminum box itself weighs about 220 pounds. The plate glass disk weighs 100 pounds, and it takes 30 gallons of solution to develop one plate. The above explanation is to show the enormous size in comparison with other machines. The lantern slide which the operator is holding is the standard 3¼ inch lantern slide used in all projecting machines. You can therefore judge the enormous size of these disks.

THE ELECTRICAL DISSOLVING EFFECT WHICH PRODUCES ILLUSION

Dissolving effects can be produced

only by the use of two or more lanterns at once as shown in Fig. 30. The lanterns must stand at such an angle in reference to each other that the disk of light on the screen shall be so perfectly registered that it appears to come from one light only. If more lanterns are used they may be placed above or between the others, tipping them so that they, too, will register their disk of light on the screen with the others. A slide placed in each lantern will be projected equally and two or three views will be jumbled together on the screen. Mechanical contrivances known as dissolvers are placed on the lanterns, by which the light in each lantern may be controlled at will. The light being cut off from one lantern only one view will appear on the screen (being shown alone it will of course be perfect). The light being cut off from the picture on the screen and simultaneously turned onto the view in the other lantern, will cause the first picture to disappear and the second one to come on the screen, and while the light is being manipulated the first appears to dissolve and fade away until nothing is left of it, and the new picture comes out clear and distinct.

The use of the third lantern is to project lightning, rain, snow and other effects in conjunction with the scenery from one of the other lanterns. The fourth is for flying objects such as birds and butterflies when they fly in opposite directions.

VALUE OF ELECTRICAL EFFECTS

Great tragedians lay important stress upon their scenery, stage settings and electrical effects. No actor of prominence will, even for the sake of financial gain, place insignificance upon these essential adjuncts. The greatest actors of the present day engage only the most clever and experienced stage managers to see to the minute details of the stage

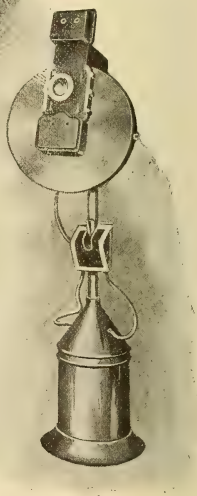


FIG. 28. THAT THERE IS A WOMAN IN THE MOON CAN BE PROVED BY A NATURAL FACT

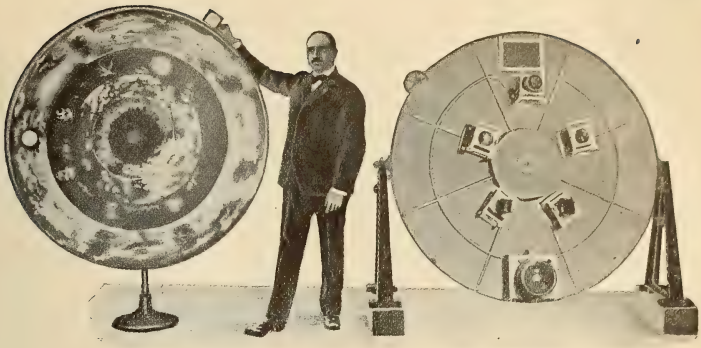


FIG. 29. THE LARGEST TYPE OF MOVING PANORAMIC SCIOPTICON

settings for their respective plays. Expensive auxiliaries they would fain dispense with were it not to their advantage in playing upon the psychological and sentimental feelings of their audience. Richard Mansfield and Sir Henry Irving, the foremost tragedians of the two hemispheres, are said to have claimed that the greater part of their success and prestige depended upon the infinite attention and detail they gave to their scenic and electrical effects. From this the reader can readily glean the fact that the expert stage electrician as well as the actor must play his part well.

THE BAD STAGE MANAGER

A bad stage manager or a well dressed, dandy "know-it-all" is a thing to be deplored. Not only does he get "in bad" with the star, but he becomes the laughing stock of the whole stage crew by his infinitesimal knowledge of stagecraft. His importance quickly drops below par the very moment the boys get wise to the fact that he is a rookey. Then it puts them all on their guard, for it is a foregone conclusion that he is going to make things ten times harder for them, even if he does get off without "crabbin' de show."

STEALING CURTAIN CALLS

There are few stars who do not attempt to steal curtain calls, especially on a Monday night. The reporters are there then. Of course the paper next day must tell of their success, so the "curtain-gag" is worked overtime. The star will have her stage manager trip the curtain again and again while she bows and salaams, while the poor men in the fly gallery are developing their muscles and tearing and blistering their hands in their effort to help the star to "make good." Of course, if the curtain happens to be of plush, and on the draw order, the flymen get a rest. In this case the stage manager and assistant stand at the opening and pull on the curtain to make the audience think that it is going to see the star, while she may be 30 feet away in her dressing room. If the manager can thus scheme on the audience and bring forth the applause, the star is sent for and she, smiling, has stolen a dozen more curtain calls than she deserves. Nevertheless, she usually actually believes there were still more coming to her. This is part of the stage manager's duty, for she must be petted, and if she were not then the business manager would be looking up a new one who would steal these curtain calls. Oftentimes the audience, seeing the apparent swing of the curtain, believes the star is coming out to bow again when it is only the stage manager jollying them along.

There is nothing that makes an audience sit up and take notice as quickly as the simple throwing on of the house lights. In case of fire this is the stage electrician's first duty. If any disturbance should occur, this is his first action, or should there be catcalls he must be equal to the occasion, and a bright light will dispel disorder as quickly as a blue-coat's appearance will break up a fight. But such extraordinary conditions are not always necessary. Sometimes, when the star goes too far in wanting curtain

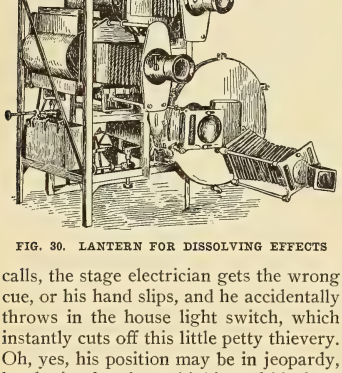


FIG. 30. LANTERN FOR DISSOLVING EFFECTS

calls, the stage electrician gets the wrong cue, or his hand slips, and he accidentally throws in the house light switch, which instantly cuts off this little petty thievery. Oh, yes, his position may be in jeopardy, but he is oftentimes thinking of his family waiting patiently for his homecoming.

A Pull Chain Adapter

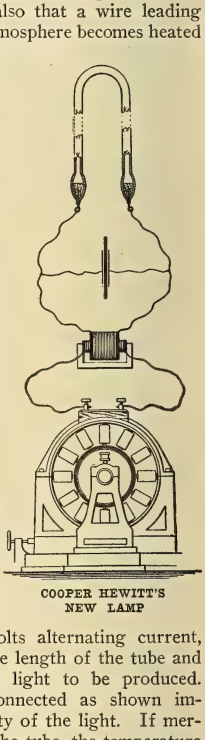
Although the pull-chain sockets are undoubtedly much more convenient than those of the key type, still their substitution is rather expensive when the old ones have to be discarded.

ADAPTER

The Hubbel pull socket with lamp base attachment is so designed that any one can make the change by merely screwing the base into the ordinary key or keyless socket.

Novel Tube Lamp

Vapors of mercury, sodium, iodin and some other metals each produce a light with colors peculiar to itself when electric current is passed through them. It is well known also that a wire leading into a rarified atmosphere becomes heated although the same sized wire will conduct the current under ordinary conditions without heating. Upon these facts is based a lamp patent issued recently to Peter Cooper Hewitt, of New York City.



COOPER HEWITT'S NEW LAMP

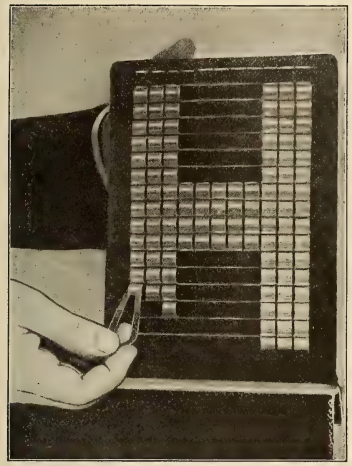
The lamp used to illustrate the patent is a U-shaped tube, inverted, containing the liquid metal, at the ends which hold sealed-in electrodes. The light will operate on from 500 to 5,000 volts alternating current, depending on the length of the tube and the quantity of light to be produced. A condenser connected as shown improves the quality of the light. If mercury is used in the tube, the temperature during operation is about 300° C. "I have also found that the combination of two or more tubes, each giving light of a different color, is advantageous," says Mr. Hewitt.

There are at present installed in the United States and Canada approximately 80,000 electric signs, containing about 8,000,000 electric lamps.

An Electrical "Spelling" Machine

A New York concern has recently placed on the market an ingenious electrical "spelling" machine, applicable not only to certain commercial fields, but even to kindergarten work.

The simplest form of the machine is



SIMPLE FORM OF "SPELLING" MACHINE FOR KINDERGARTENS

shown in the accompanying illustration, and is the one used for kindergarten purposes. It consists of an oblong sheet of metal pierced with slits as shown. In each slit is inserted a curved strip of tin, silvered to distinguish it from the sheet frame. Normally these tin strips are out of sight behind the frame, but may be drawn out by means of a magnet. By drawing the magnet down over the frame, letters and characters may be formed as seen in the picture. Although the form just described is attaining a wide popularity for educational purposes, there are other and wider fields for use of the same principle.

Perhaps the greatest commercial application of the principle lies in the electric daylight sign. The main frame is posted up in a conspicuous place and may be of any size desired, the tin movable strips being ready to spell out the letters of the sign. The strips are then turned out into view — not by a hand magnet as in the case of the kindergarten device, but by an ingenious arrangement of electro-magnets and electrical circuits running to a special typewriter keyboard arranged for closing the circuits to operate the sign. One step further in this idea is to have the typewriter keys fitted with dies suitable for perforating a paper strip and then run this strip through a special machine for operating the sign, electrical contact for the various circuits being made through the perforations. In this way an operator is only required to perforate the strips which, afterwards, by an automatic machine, may be made to operate the sign.

Such a sign, operated direct from the keyboard, might be used to advantage in connection with a railroad station or other public bulletin board.

Washington Monument's Lightning Rods

The Washington Monument is held by many to have an ideal installation of correct lightning conductors. The apex of the monument is an aluminum pyramid, from which eight half-inch copper rods extend down to the base of the stone pyramid, forming the top of the structure. At that point they bend inward through the masonry and pass down the interior of the shaft. The eight conductors are all connected on the outside of the pyramid by a heavy rod, and they are all gold plated. Two hundred platinum tipped points, connected with the conductors and all pointing skyward, cover the pyramid. The conductors connect directly with the tops of four iron columns which support the stairway and elevator.

At the base of the monument the iron columns are connected by copper conductors with the bottom of a well 20 feet below the foundation of the shaft.

The Pathfinders of the Wires

BY WALDON FAWCET

RECENT statistics would seem to prove that the vocation of the electric lineman is becoming relatively less perilous than it was a few years ago. The stringing of electric wires goes on apace in all parts of the country—the linemen pushing farther and farther into the deserts, the forests, the mountainous regions and other virgin fields that await this great civilizing influence—yet for all this increase in the amount of field work and increase in the number of linemen employed there is a steady decrease, pro rata, in the number of fatal or serious accidents.

A tremendous reduction in the risks of the work was brought about with the introduction of the shorter poles which are in vogue today. Almost all our readers can remember, probably, when a telephone or telegraph pole less than 40 feet in length was almost unheard of, 50 feet being the more common. Nowadays the 25 foot pole may be said to be standard unless tree conditions necessitate the carrying of lines at unusual height. Finally, the tendency to adopt the underground system in most of our large cities has helped the average lineman's chances of longevity by relieving him of much of the work which in the old days had to be carried on from poles or housetops amid a perfect network of wires.

But for all that the present day lineman may discharge his responsibilities with less danger to life and limb, he must even yet face far more risks than the private in almost any other division of the industrial army. And this brings to mind the fact that the linemen past and present have had all too little credit for the very important part they have played in the advancement of electrical science. What the prospectors are to the mining industry, what the track layers are to railroad construction and what the pioneers of the trans-Mississippi region

were to modern farming interests these pathfinders of the wires have been to the conquest of the magic current.

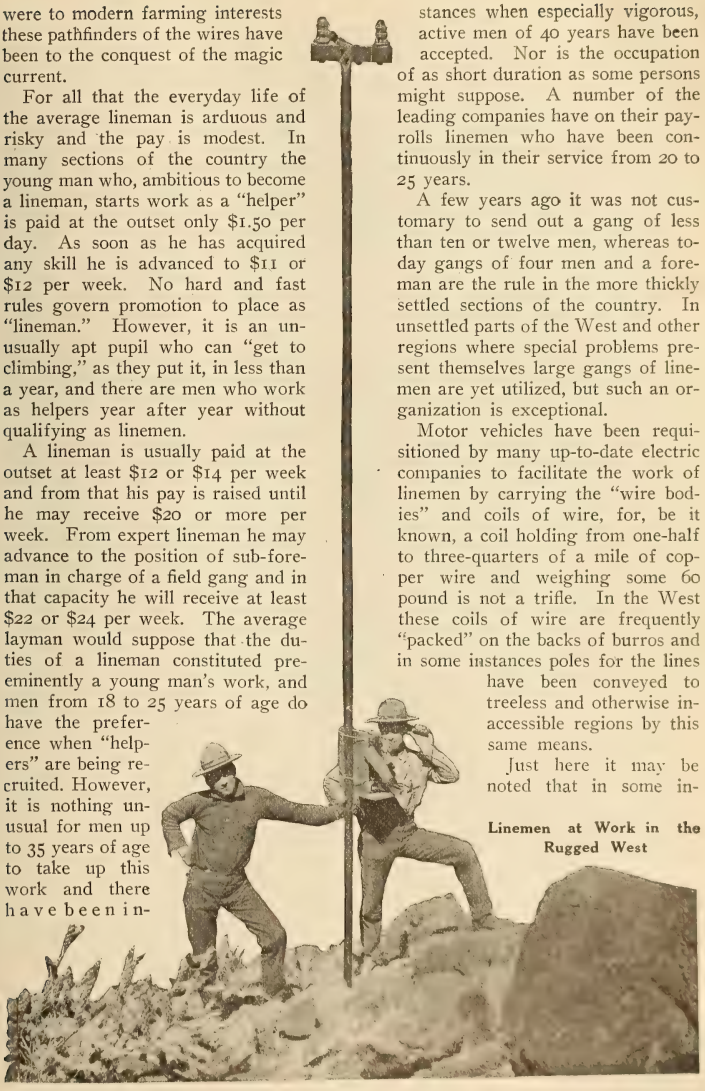
For all that the everyday life of the average lineman is arduous and risky and the pay is modest. In many sections of the country the young man who, ambitious to become a lineman, starts work as a "helper" is paid at the outset only $1.50 per day. As soon as he has acquired any skill he is advanced to $11 or $12 per week. No hard and fast rules govern promotion to place as "lineman." However, it is an unusually apt pupil who can "get to climbing," as they put it, in less than a year, and there are men who work as helpers year after year without qualifying as linemen.

A lineman is usually paid at the outset at least $12 or $14 per week and from that his pay is raised until he may receive $20 or more per week. From expert lineman he may advance to the position of sub-foreman in charge of a field gang and in that capacity he will receive at least $22 or $24 per week. The average layman would suppose that the duties of a lineman constituted preeminently a young man's work, and men from 18 to 25 years of age do have the preference when "helpers" are being recruited. However, it is nothing unusual for men up to 35 years of age to take up this work and there have been instances when especially vigorous, active men of 40 years have been accepted. Nor is the occupation of as short duration as some persons might suppose. A number of the leading companies have on their payrolls linemen who have been continuously in their service from 20 to 25 years.

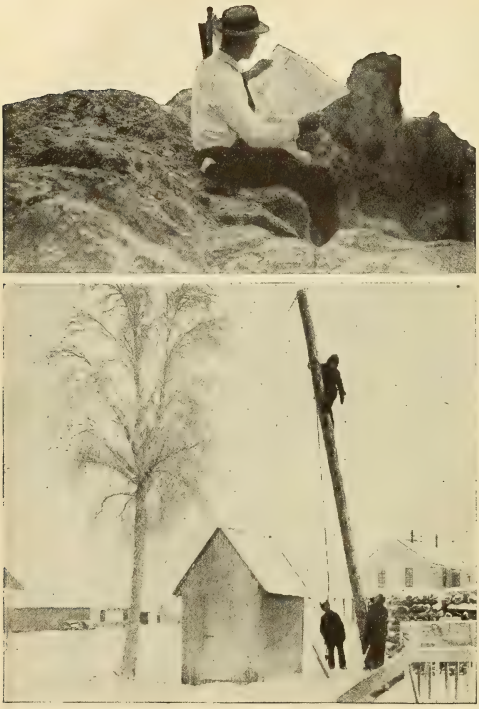
A few years ago it was not customary to send out a gang of less than ten or twelve men, whereas today gangs of four men and a foreman are the rule in the more thickly settled sections of the country. In unsettled parts of the West and other regions where special problems present themselves large gangs of linemen are yet utilized, but such an organization is exceptional.

Motor vehicles have been requisitioned by many up-to-date electric companies to facilitate the work of linemen by carrying the "wire bodies" and coils of wire, for, be it known, a coil holding from one-half to three-quarters of a mile of copper wire and weighing some 60 pound is not a trifle. In the West these coils of wire are frequently "packed" on the backs of burros and in some instances poles for the lines have been conveyed to treeless and otherwise inaccessible regions by this same means.

Just here it may be noted that in some in-



Linemen at Work in the Rugged West



Locating a Line in Mountain Regions. Building a Line in the Dead of Winter

stances linemen stringing communicative lines in rocky, mountainous regions in the West have utilized the hollow iron poles. Holes have been drilled in the solid rock, the pole put in place and then concrete poured in to fill the depression and hold the pole in place.

In wire work use is also being made of motorcycles, particularly by the "combination men." These combination men, or "trouble shooters," as they have been dubbed in the slang of the trade, are a distinctive class of linemen. They derive the name "combination men" from the fact that they each can serve in the dual role of "inside" and "outside" men; that is, they can undertake any responsibility from stringing wire to installing an instrument and they are usually sent out when trouble of any kind has interrupted communication on a telephone or telegraph line.

Speaking of trouble on the electric power and communication lines it may be noted that mishaps, particularly those due to the ravages of the elements, afford the linemen their greatest opportunities for rapid and efficient work. Such emergencies also necessitate that exposure which makes frost bites the heritage of almost every lineman. A company may have anywhere from a dozen to a hundred linemen on its roll and yet the force is liable to prove inadequate to the speedy repair of the havoc wrought by a tornado, a blizzard or a severe visitation of sleet. Happily for the electrical companies such tantrums on the part of Nature are seldom country-wide in scope and usually the companies in an afflicted district can "borrow" linemen temporarily from kindred concerns in other communities.

A change that has come about in recent years has to do with the accepted plan of lodging and boarding electric linemen when absent from home on field work. Formerly all nomadic gangs carried camp outfits and pitched camp in localities convenient to their work. This method is yet followed in the more sparsely settled regions and under cir-

cumstances where a large force is engaged in stringing new trunk lines, but in the more thickly settled regions which are traversed by established wire systems the companies have made arrangements at conveniently located farmhouses for board and lodging for the linemen who may be sent out. Under this plan a lone lineman or a small gang can at short notice get board for a day or a month as the exigencies may happen to dictate.

Another "wrinkle" in this field is the provision of a "first aid" cabinet for each gang of linemen and the instruction of the men in its use so that they will be qualified to employ emergency relief measures in behalf of any comrade who may fall from a pole or sustain an electric shock.

Methods of Resuscitation That Must Sometimes Be Employed

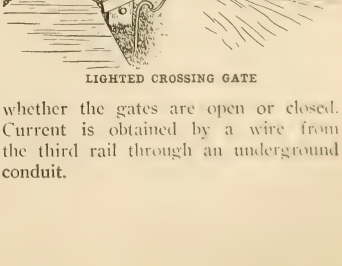
Electric Farm Lighting

The farmer of today has increased his standard of living. He demands many of the conveniences enjoyed by his brothers of the city. Most of these conveniences, which 20 years ago were looked upon as luxuries, are today considered bare necessities. The proper and efficient lighting of the farm home and farm buildings is one of them. We have but to note the introduction of the gasoline engine and the telephone in farming communities. Fifteen years ago both of these modern conveniences were looked upon by the farmer as luxuries. The modern farm electric light system marks another epoch of progress. It should be classified with the gasoline engine, telephone, and cream separator as a genuine farm convenience and labor saving device.

All of these have been given to the farmer during the past decade, and all have contributed to his comfort and general welfare. The modern farm electric lighting system, more than any other contrivance designed for lighting purposes, possesses all the features which should commend a lighting system to the farmer. —*Farm, Stock and Home.*

Lamps on Crossing Gate

A suburban electric railway indicates its crossings by five incandescent lamps mounted on each half of the "gate." The lighted lamps show the crossing at night



LIGHTED CROSSING GATE

whether the gates are open or closed. Current is obtained by a wire from the third rail through an underground conduit.

New York's Electrical Fourth

When that dear old American patriot, John Adams, second President of the United States, wrote to his wife that the Fourth of July "will be celebrated by succeeding generations as the great anniversary festival" and that "it ought to be solemnized by pomp and parade, with shows, games, sports, guns, bells, bonfires and illuminations from one end of the continent to the other," it was quite impossible for him to foresee the terrible toll that would be exacted by modern fireworks, and it seems hardly fair to blame him, as some do, for the wrong start in the way of celebrating. His opinion today would probably be quite different.

President Adams, however, was not altogether wrong, for he struck a keynote when he said "illuminations." After all, there is only one way of celebrating at night and that is to dispel the darkness with electric light.

The electrical Fourth of July as it now stands is a thing of beauty as well as of safety. Many colored lights, arranged in artistic designs, flash out in rare impressiveness their messages of patriotism. Residences, statuary, bridges and other edifices, as well as the trees in the parks, can be strung with lights or outlined in red, white and blue, in such a manner as to bring forth unrestrained admiration. And they are permanent objects on which the eye may gaze, drinking in all of the beauty, while on the other hand the fireworks are of but a moment's duration—just a transitory gleam, and gone.

ILLUMINATIONS AT MULBERRY BEND, COLUMBUS PARK, DURING NEW YORK'S SAFE AND SANE FOURTH

In New York City this year fourteen public parks and squares were illuminated by special electrical effects. Six thousand electric light bulbs of eight candlepower each were used in lighting the City Hall and City Hall Park. The famous old pile glowed like a palace in Arabian Nights set in the midst of an enchanted garden. Festoons of electric lights hidden in Japanese lanterns were strung from tree to tree all through the park. A similar plan of decoration was carried out on Borough Hall in the Bronx, the current for the three night illumination of these two buildings, together with the wiring, being supplied free by the Edison Company. Nearly 100,000 incandescent bulbs were used in the illuminations throughout the city.

Electricity Conquers the Welsh Orme

Possibly you are not exactly familiar with the Ormes. There are the Great Orme and the Small Orme and they form the background to Llandudno, the world famous seaside resort of Wales. For time immemorial every visitor

TODAY YOU CLIMB THE ORME BY TROLLEY

climbed them; but today—well, today you go by electric car.

On the long white car one hears as much English spoken as Welsh; folk are discussing what they shall order when they reach the great restaurant at the top.

You remark how there are practically no Welsh left wearing national costume, as you survey your colleagues in the car.

Splendid residences, the most of them built of a grey concrete, are all about you. Advertisements of coaching tours punctuate open vistas. By the track, walls of a grey stone begin rising, though passengers are able to look over these. Above their zone come gardens of chestnuts.

Presently we stop at a series of buildings, before which we dismount to change cars for the summit. It is rather picturesque here, in the rolling upland, walking 'cross the stony fields, bare save for the low grass blades, and occasionally divided into sections by fences of rocks. Behind us, lesser ridges rise in the mist; ahead is the track, with two cable ropes at its center and trolley wires stretched above to poles at the sides. On and away, one sees these stretching, across the barren hills, winding, but yet making a gradual ascent.

As the ride is continued up mountain, somehow it makes one think of the trip up Mt. Lowe. It is cool and you almost envy three ladies you see climbing the Orme by a footpath. Finally you come to the end of the journey at the great Orme Hotel. Mountain meadows invite you to stroll, or to rest, as do most in the gravel of their slopes. It's windy and cool and delightful and one gets a fine view of the sea. That though is an old, old story,—one not quite so interesting, to Welshmen at least, as that electricity has conquered the Orme.

An Old-Time Mine Signal

The simplest form of mine signal was not operated by electricity. It was installed in a slope mine where the bottom was over a mile distant from the hoist house. The signal consisted of a bell located in the hoist house and a single wire attached to the bell and leading down the slope to the bottom or parting 7,000 feet away. The cars were hauled from the face of the parting by electric locomotives and from the parting to the surface the cars were pulled up the slope by the hoist. When the trip was ready to be taken, the engineer was signaled by pulling the wire above referred to until the bell rang. One can imagine the friction and lost motion incident to the operation of such a device. The united efforts of several men were usually necessary to send a signal from the parting, and they say that sometimes it was necessary to hitch a mule to the wire in order to operate the signal. Nowadays telephones are used in many mines for such service, and their use is increasing. The telephone instruments are designed especially for underground service, and are enclosed in an iron box designed to be moisture proof.

Hydro-Electric Wonders in California

By ARCHIE RICE

This is the fourth and last paper of the series. The others showed types of progressive developments from California's remarkable natural water power. Each bore upon some specific phase of industrial life directly benefited by the application of cheap electric power sent long distances. In this article is presented one of the largest installations—one on the west coast. It has about 40 miles of flumes and ditches leading a diverted riverflow to where it can be dropped from a perpendicular height 1,450 feet to drive impulse wheels. This energy is sent off over hills and across valleys to work deep mines, irrigate orchard lands, pump out inundated delta districts of great agricultural richness, run big cement works, propel electric cars, light cities and supply power to half a hundred other industries throughout a territory the size of Ohio.—Editorial Note.

THE FAMOUS ELECTRA PLANT

It came about that I took a manufacturer with me to see a great hydro-electric plant back in California's mountains, 50 miles or so to the northward of the Yosemite. Toward the end of our long railroad trip from San Francisco that day I pulled a notebook from my pocket and opened it at some figures. The figures caught the eye of the manufacturer and engaged his attention.

"Do you know," I began, "that California has the greatest hydro-electric possibilities of any part of the world? I'll tell you why.

"Wherever you find a steep river there is someone's chance to divert the water by an easy gradient and then produce an artificial fall from a considerable height.

"The source of the Mississippi is only 1,500 feet higher than its mouth. The average gradient of its flow is only about seven inches to the mile. The Ohio drops only 700 feet in its thousand mile course. But there are more than a dozen rivers in California that drop from fourteen to 300 feet to the mile. Most of them are very much steeper than that back in the mountains. Where such a river is flanked by slopes and ridges, then there are chances to lay out diverting ditches.

"Now, just scan these figures:

River	Miles Long	Feet Descent	Foot-drop to Mile
Eastern—			
Mississippi	2,300	1,500	.6
Ohio	1,000	700	.7
Missouri	2,340	4,000	1.7
Connecticut	375	2,000	5.3
Eastern—			
Kennebeck	150	1,000	6.6
Rio Grande	1,800	12,000	6.6
Hudson	300	4,300	14.3
California—			
Calaveras	68	1,000	14.6
Sacramento	400	7,000	17.5
Feather	136	4,678	34.4
Tuolumne	155	8,000	51.6
Stanislaus	113	8,000	70.8
American	118	8,500	72.0
Yuba	90	6,700	74.4
Cosumnes	93	7,500	80.3

"At the next stop we'll leave this little train. Then we'll go three miles by stage to the old mining town of Jackson. It is in Amador County.

"From Jackson a private mule team will take us eight miles to a place on the Mokelumne River. There you'll see a whale of a power plant. We'll arrive just in time for supper.

"But tomorrow we'll put in a day seeing the whole enterprise—the river, the diverting ditches and flumes, the saw-mill making lumber for the flumes, the storage reservoirs, the pressure pipes coming down a steep mountain side, the tramway up and down that mountain and the machinery of the splendid great plant itself, where 28,100 electric horsepower is constantly generated. It is sent through all this rich old mining district and out to the valleys and to half a hundred city industries. It even goes to cement works on the seacoast near Santa Cruz, 140 miles from the mountain plant. And it supplies all the electric lights on the campus at Stanford University."

THREE-ACRE FOREBAY RESERVOIR ABOVE THE ELECTRA POWER PLANT. THE WATER ENTERS HERE AFTER TRAVERSING 20 MILES OF MOUNTAIN SLOPES AND RIDGES FROM THE RIVER DAM

After supper at the club house, prepared by Ah Charlie, the most famous Chinese cook in the mountains of California, we sat in a great group on the broad, vine-covered veranda overlooking a beautiful lawn. Electric lights made grounds and surrounding buildings like some summer resort in the moonlight.

Unceasingly rose the hoarse groaning hum of the generators down in the power house. We strolled over to the long building, escorted by the superintendent.

"Let me have your watches," said he, holding his own and extending a hand for ours. The manufacturer looked at me. I nodded an approval meant only for his inquiring glance.

"We'll leave them here till we come out," remarked the superintendent. "These generators magnetize the steel of the works and play the deuce with a watch's accuracy."

The manufacturer was still cautiously peering at the ponderous wheels when I left. We were due to start for the sawmill at three the next morning. But he didn't know it then.

To the southward from famous Lake Tahoe is Alpine County. It is part of the ridgepole of the Sierras between California and Nevada. Terraced high along its western slope are natural basins filled with melted snow water. There are four in one group. They range in area from 120 to 340 acres. They are from 20 to 60 feet deep, and they are at an elevation of between 5,700 and 8,200 feet above sea level. That group is called the Blue Lakes.

These lakes of high mountain snows are 80 miles up in the Sierras back of the Electra power plant. Artificial canals connect them. By opening headgates any amount of water desired can be let into the upper channels of the Mokelumne River to increase its flow. During the six months' rainless season, when the water in California's mountain streams gradually decreases, an auxiliary supply becomes necessary for the big power plants.

For 50 miles the artificially stored snow water flows down the regular mountain channel of the Mokelumne. Then a ditch and flume system tap the river at a dam and lead the diverted flow winding along the corrugated ridges a distance of 20 miles to the top of the hill back of the Electra power house. In those 20 miles the Mokelumne River has dropped more than 1,600 feet. But the ditch has come along by an almost level gradient and saved up energy for a final perpendicular fall of 1,450 feet to

the impulse wheels;—that is, a plunge more than eight times as high as Niagara Falls.

Blue Lakes and two other storage reservoirs connected with the system comprise an area of 950 acres and store an aggregate of 1,080,000,000 cubic feet of water. This is to supplement the river's normal flow and guard absolutely against the shortage of any long dry season.

THE ELECTRA POWER PLANT IN THE CANON OF THE MOKELUMNE RIVER. DOWN THE STEEP PIPE LINE AT THE REAR THE WATER TAKES THE FINAL PLUNGE FROM AN ELEVATION OF NEARLY 1,500 FEET

Like most of California's hydro developments, the Electra plant was evolved from small beginnings. In the early '90's, when the world was beginning to see possibilities in the transmission of hydro-electric power, there came to California a scion of a royal family of ancient Poland. Tall, slender, esthetic looking, socially prominent, young Prince Andrea Poniatowski did not look the part of a big promoter. But he went up into that Mokelumne mining country and used his eyes and ears. He saw many abandoned mines along the river. And he decided that, if combined for economical operation, they could be made to pay. While he was quietly buying them up he also cast an eye upon the Blue Lakes water system, used since 1871 for bringing water to the mining towns of Jackson, Sutter Creek and Amador City. Why not buy up the water company, too? Then a big drop could be created from some point along the ditch and a hydro-electric plant established to supply power to his combination of mines.

With the capitalistic backing he was able to attract to his scheme, he made all this come true. But the first plant was only a little affair. It was three miles down-stream from the present Electra power house.

The idea grew as he studied it. By 1898 mammoth plans were afoot for the

production of enormous power. Every detail was handled with minute scrutiny and study. Famous engineers were engaged.

So sure were the promoters that they would not fail that they set about building solidly and with infinite care. They took four years for the work. Electrical manufacturers in Massachusetts proposed the then amazing idea of operating the power lines at 50,000 volts and at a saving. The current was to be carried to Oakland on San Francisco Bay. Special machinery was accordingly made.

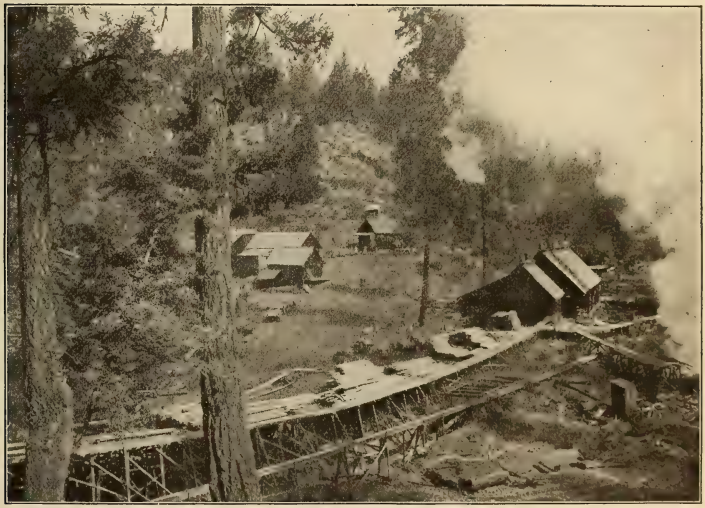
Four construction camps, each with from 100 to 300 workmen, were established back in the mountains to repair and enlarge the aqueducts and prepare for the great new plant.

The builders confidently made contracts in advance, guaranteeing to deliver so much power to different distant customers at a certain date. And they were not disappointed.

But before the Electra plant was actually producing energy in 1902 a rival installation, the great Colgate installation on the Yuba River, was sending its current across the Sacramento Valley into Oakland.

All the hydro-electric plants described in this series of articles, along with ten others, are now combined into one interconnecting system, feeding into a great comprehensive network of wires and distributing through some 200 local electric stations. The area that this system covers is three-fifths the size of New York State. It embraces two-thirds of California's entire population. The historic plants that have appeared in this series are really types in what is now the largest hydro-electric enterprise in all the world.

"It's plain idiocy to start anywhere at 3 o'clock in the morning," complained the manufacturer. But we had him up and out on the great arcade porch.



HERE IN THE REMOTE SIERRA FOREST ARE HARVESTED LOGS AND LUMBER TO REPAIR THE FLUME OF THE ELECTRA POWER PLANT

The same electric lights were everywhere. The same droning hum came insistently from the power house. The clear vault of heaven canopied the cañon and shone with brilliants.

"I'll take you to the tramway," said the superintendent. "They've led the mules up the trail an hour ago. There's a wagon at the top, sent round 20 miles by a road that goes out of Jackson and along the ridges."

"How about breakfast or a little coffee?" suggested the manufacturer.

"You get breakfast at the sawmill," was the superintendent's reply. "I've telephoned you're coming."

A brilliant constellation glowed where the mountain touches the sky. "Lights at the forebay," explained the superintendent. "The tram'll snake you up there in seven minutes. It's 2,400 feet."

The manufacturer perched on the cleats below me on the long open toboggan. The superintendent pressed an electric bell. A warning ring came back in response. The car jerked, jerked again, and then went steadily up and up out of the cañon. We sat like lonely spectators on a narrow slice of bleachers starting mysteriously for the moon and looking down rather regretfully upon the retreating joys of earth and an Ah Charlie breakfast.

'Way up it jerked again. "I wonder what's the tensile strength of that cable," commented the manufacturer. There was anxiety in the tone.

The mule team was waiting. And on and on we drove through a sparse forest. And then through a mile of sputtering and crackling and pyrotechnic acreage where a forest fire had passed and left the road a distinct pale streak across an undulating blackened carpet flecked with glowing sparks.

We came finally to a long descent so steep that the collars pulled out to the mules' ears and the animals struggled back desperately trying to keep the rig from overrunning them.

We skidded down into an actual road at last. And on we drove through forest ravines. Then suddenly the panorama of a little settlement in a clearing opened before us. There was a shrieking saw at the mill, a loud welcoming honkey-honkey-honkey of a mule on a big lumber wagon, and the peculiar squealing noise of log cars sailing round the curves of the gravity road from the timber section farther up the ridges.

We had arrived at the Tiger Creek sawmill. It was nine o'clock, and we had driven 30 miles before breakfast.

There in a primeval province of bears and rattlesnakes they were cutting timber and making lumber for the annual repair of the many miles of flumes to the power house and from the forebay reservoir on through the hills to supply water to the great mines at Jackson, Sutter Creek and Amador City.

Waiting for the slow lumber teams to get a long start, we followed them down to the head dam in the Mokelumne River.

There the lumber is piled high. It waits for telephonic orders for certain amounts and sizes to be dumped into the canal and floated down to auxiliary piles along the course.

The whole vast electric system is covered intimately by a comprehensive private telephone service from the cities to the far-off snow water lakes high in the mountains.

When we got back to the top of the ridge and onto the toboggan tramway, hours later, we were models done in red clay.

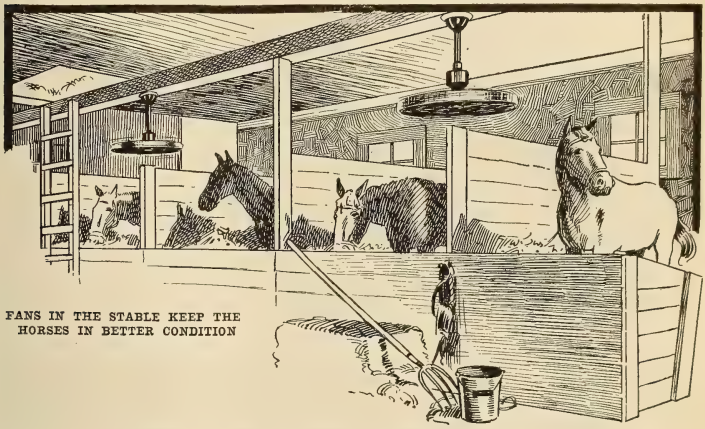
The dust of those forest roads is finer than flour. It covered us with the thickness of a woolen blanket. Our eyelashes were red dough; our hair and eyebrows brushes full of cayenne pepper.

"Sixty miles in this kind of up-and-down country is a little too much riding for one day," complained the manufacturer, as he limped stiffly to a place on the tram.

"The Blue Lakes are 50 or 60 miles beyond where we went, eh? Well, there's a whole lot in California I'd rather read about and see photographs of than punish myself going to see."

Keeps Horses Cool and Comfortable

The owner of a large livery stable in an Indiana city has found the installation of electric fans for keeping the stable cool and free from flies a paying proposition. The expense for power is more than justified by the comfort to the horses during the extremely hot weather. Instead of standing up to fight flies, the horses are able to lie down without being pestered by flies, do a harder day's work, and keep in better condition.



FANS IN THE STABLE KEEP THE HORSES IN BETTER CONDITION

Death From an Improvised Electric Needle

A very peculiar case of accidental death came to light recently in Pittsburgh. Charles Beab, chef at the Union Station Restaurant, was found dead in his room with an improvised electric needle stuck into his back. As he was a sufferer from rheumatism, it was quite evident that he had attempted to get relief from an electro-medical apparatus of his own devising. He had taken a ten foot length of lamp cord and attached one end to one terminal of the light socket. The many fine wires of the other end of the cord he had fanned out as a surface electrode to hold on his chest. Another wire for the other terminal of the socket carried at the outer end a sharp needle, which he had thrust into his back. In this way the full force of the current had passed through his body. Although only the ordinary lighting voltage was present, it was sufficient under these conditions to cause death.

Complexity of Telephone Field

"No one man knows all the details now," said Theodore N. Vail. "Several days ago I was walking through a telephone exchange, and I saw something new. I asked Mr. Carty to explain it. He is our chief engineer; but he did not understand it. We called the manager. He didn't know, and called his assistant. He didn't know, and called the local engineer, who was able to tell us what it was."

Either a voltmeter or hydrometer may be used to determine when a battery is fully charged, but preferably both methods should be employed, one as a check on the other.

Miniature Lamp Letter Sign

No circus side-show of a decade ago was complete without its marvelous Bohemian glass blowers, who, on their plush draped pedestals, did all manner of things with variously colored glass. It is somewhat with the same feeling of wonder and interest that one watches the marvelously delicate processes in the factory where are made the Federal alphabet letters, an electrical product of the glass blower's skill. Each letter is actually a tubular incandescent lamp in the shape of a letter, with a special base which slopes into the frame or fixture holding the sign, connecting by its terminals with the circuit that lights the lamps.

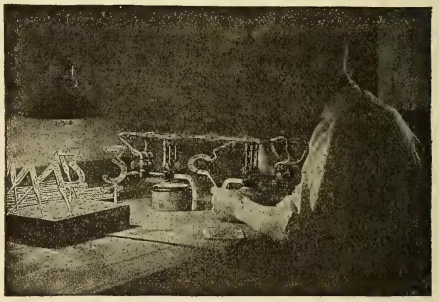
WIRING AND CONNECTING THE BASES

Skilled glass blowers bend and shape the letter, according to patterns, leaving attached to the letter short, glass stems through which the air is finally exhausted. They work in semi-darkness, as a bright light makes it impossible to see the tip of the almost colorless but intensely hot flames that are focused on one point from the two sets of triple blowpipes operated by compressed air.

The letters are then taken to the sealers who seal into the wall of the letter the tiny carbon filaments or "beads." These beads consist of a small hairpin shaped platinum wire embedded in a glass bead with the tiny carbon filament cemented to the ends of the wire.

The glass is heated to softness where the filament is to be, a small hole made, and the filament inserted and the glass bead fused into the wall of the letter. This must be absolutely air tight and is constantly tested by blowing through the glass tube attached to the letter. A good sealer can finish 80 letters or more in one day.

The letters are then sent to another operator who connects these platinum wire terminals in series by fusing copper wire along the outside of the letter. At this stage, the letters are fused by their glass stems on a "fork," a glass tube with 25 branches, each connecting the air chamber in the letter with the central stem. They are then taken to the mercury vacuum pumps and the air exhausted, with the letters subjected to heat and with the current turned on the filaments, an operation requiring anywhere from 20 minutes to two hours, during which any slight leak that may develop means starting all over again.



GLASS BLOWER MAKING THE LETTERS

The letters are taken off the forks by heating each stem with a tiny flame until the glass softens and fills the opening and the letter is pulled off before the glass hardens.

The letters are then "backed," the wiring on the backs being covered with a white composition which is moulded by hand on each letter, protecting the wiring and making a white reflecting surface. The letters are then mounted on the square porcelain bases, which are really interconnecting push plugs through which the current flows from each letter to the next. If a letter is broken this base carries the current so that all other letters are lighted.

Electrical Warmers for Baby Cribs

There has been devised for use in the children's ward of the Presbyterian Hospital, Philadelphia, an electrical crib warmer that has been found to be less costly and less troublesome and more effective than hot water bottles. This electrical contrivance, which is contained between asbestos coverings, is made to extend over the whole bottom of the crib, but so arranged as to give the greatest degree of warmth at the feet.

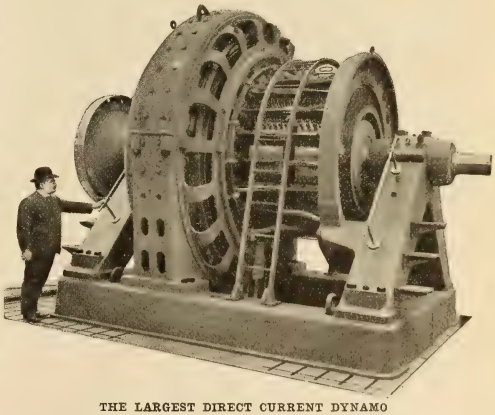
The heat of the entire warmer can be regulated by switches and it can be kept constant at any stage of the day or night. Electricity is supplied through a flexible cable from the house current.

Evil Lighted Into Harmless Gayety

From an ethical point, ornamental street lighting systems are of value because they decrease the possibilities for successful commission of crime, and so transform the thoroughfare after dark that loafing and hoodlumism are impossible and the acts of the recklessly disposed of both sexes, of whatever age, are literally lighted out of evil into harmless gayety and amusement. The thoroughly lighted street cannot be made the theater of wrongdoing.

The Largest Direct Current Dynamo

The Iluminium Industrie, Ltd., of Neuhausen, Germany, has had constructed two of the largest direct current dynamos ever built. They are to be used for electro-chemical purposes, and were built by the Oerlikon Machine Works. One of these machines is shown in the picture, and, judging by the stature of the man, must stand at least fifteen feet high.



THE LARGEST DIRECT CURRENT DYNAMO

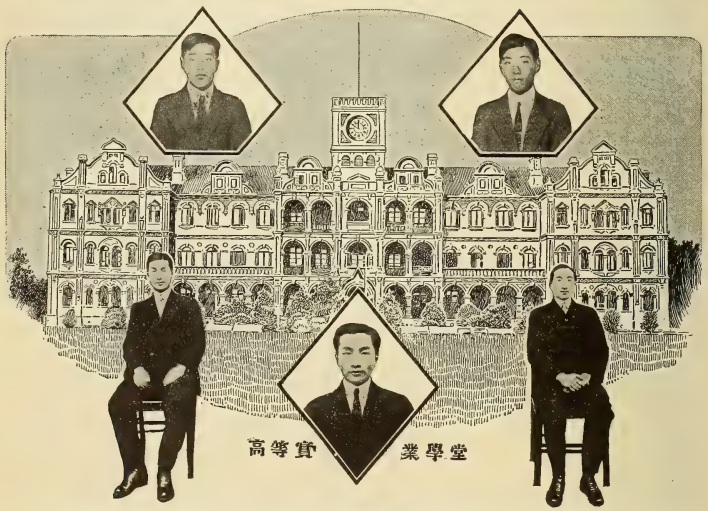
At the right is seen the huge commutator, almost as large as the main part of the machine. A curved ladder passing up over the commutator is necessary for the attendant when adjusting the brushes.

It requires 3,850 horsepower of energy to drive this generator when it is delivering its normal full load output of current. Seven thousand eight hundred amperes of current at a pressure of 340 volts represents its regular duty as a current producer. This is enough to light about 50,000 sixteen candlepower lamps.

Chinese Students Study American Telephone Methods

It has been a common thing during the last fifteen or 20 years for the Japanese government to send students to pursue a course of studies in the colleges and apprenticeship courses in the manufacturing establishments of the United States. This policy has been beneficial to Japan as a nation, as evidenced by their achievements in recent years. Probably owing to the fact that large bodies move slowly, China, however, has not, until a very short while ago, seen fit to take advantage of these opportunities for those of her young men who wished to embark upon professional careers.

A new era, however, is dawning in the Celestial land. Political upheavals have taken place and the desire for progress has expressed itself emphatically. As early as 1911 the Government Technical College at Shanghai, or Nanyang University, as it is now known, decided to send a number of the young men of its graduating class in electrical engineering to this country. Partly because these young men expressed a preference for telephone work, and partly because of a belief that this phase of the electrical industry will develop first and fastest in the next few years in China, the first five men to open the way chose telephone engineering, and their university selected the Western Electric Company, Hawthorne, Ill., as the place for training. Here they will study the manufacture, distribution and engineering side of the telephone industry.



MAIN BUILDING OF NANYANG UNIVERSITY IN CHINA AND FIVE OF ITS GRADUATES WHO ARE AT PRESENT TAKING A PRACTICAL COURSE IN TELEPHONY IN ONE OF OUR GREAT MANUFACTURING PLANTS

In July, 1911, Chu Fu I, Long Kuo

Tsan and Swan Pao Kien left China for America, and were followed a little later by Frank P. Dunn and Ngo Chung. The last two remained, as explained in their letter, which follows, to help make China a republic, both serving in the revolutionary army.

While interviewing Mr. Dunn and Mr. Chung at the Western Electric shops, a representative of POPULAR ELECTRICITY MAGAZINE met with a surprise in listening to the very good English in which these men expressed themselves. This, however, was explained by the fact that at the Nanyang University the engineering books used are in the English language.

A NANYANG UNIVERSITY TEAM

These young men will return to their native land after completing their work here and will doubtless be heard from in the telephone field.

Herewith is printed, as received, a letter written by request by Messrs. Dunn and Chung to readers of POPULAR ELECTRICITY MAGAZINE, telling something of themselves and their country:

"Permit us, first of all, to give you a little idea about the history of our University, that has undergone several changes in name. Up to 1904 it was known as Nanyang College, which name, we presume, is better known over this country as well as in European countries even now. Between 1905 and greater part of 1911, being under direct control of and supported financially by the Board of Post and Communication of the late government, it received the name 'Imperial Polytechnic College,' and though the organization changed a little, the activities of the faculty remained as strong. In the October last, when the city Shanghai, where the college is situated, as well as the whole of province Kiang Su, were taken by republicans, the name Nanyang University was given to it, under the management of Mr. W. C. Tong, one of the presidents devoted to the progress of the college. The only change was the separation of the college from the said Board at Peking. Courses of law, political science, and medicine were then planned to be added to the electrical railroad and marine engineering courses, which are in parallel.

"Towards the idea to take electrical engineering as course of our study, we knew that the application of the electricity by different discoveries and inventions has become one of the most important and interesting subjects in the industry of today. There is plenty room yet for one to distinguish himself by discovering new theories and inventing new systems and devices which are the best hope of a student in the electrical line.

We learned that the telephone engineering is one of the most important electrical industries of today and will find better opportunity in our country than it is here. Our college year was 1911. Being kept back by the revolution, we

helped the republicans with our engineering knowledge in our respective towns. Never before in the history of any country in the world has met with such a successful yet bloodless revolution as has the Chinese revolution. The beauty of it has been that we made the so-called 'baby emperor' abdicate by allowing three million dollars annually as pension in order to avoid the bloodshed of the war. During the revolution uttermost care had been taken to protect the foreigners from danger as well as their personal properties, and fortunately no one of such case had ever reported. Dr. Sun Yat Sen was made provisional president and later he resigned with a recommendation to put Mr. Yuen Shi Kai in front, which the people agreed. This was in the February, 1912. Our work in the revolution is thus accomplished. Devoted to straightening up the country, the new government sent us abroad.

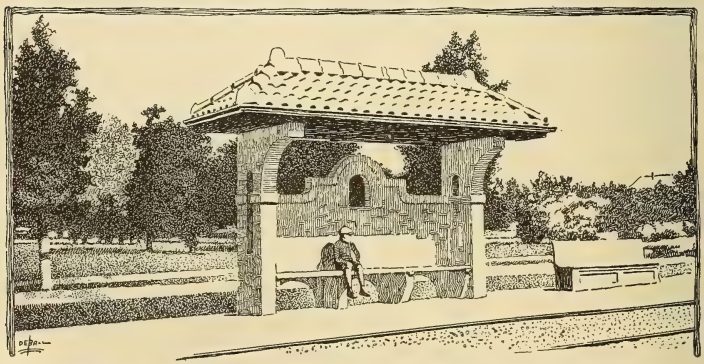
"Since our entry in the Western Electric Company we are quite interested in our work and under the systematic and efficient instructions we are quite sure that in course of time we shall probably be the pioneers in China.

"Trusting this will give you a fair idea of who we are and why we join the telephone engineering course here, we remain Yours cordially,

"N. CHUNG,
"F. B. DUNN."

ARTISTIC REST STATIONS IN PASADENA

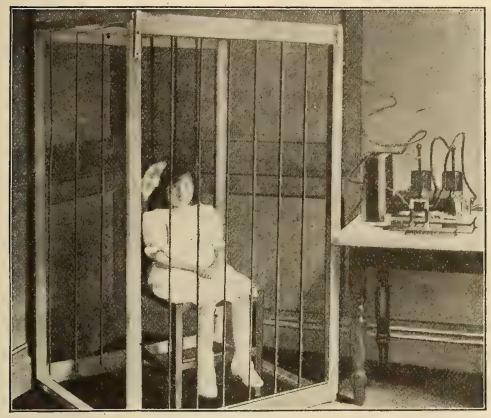
No more does the wornout street car from the '80s serve as a resting place for street car patrons in Pasadena, Cal., and the rough and ready benches provided for the same purpose by local advertisers and inscribed with advice about pills or "gent's furnishings"—all these must go. Such makeshift waiting places for street car patrons are now being replaced by concrete structures of Mission design with red tiled roofs. The Pacific Electric Railway Company has a real interest in Pasadena, and will add to its popularity by these structures, which ornament the beautiful neighborhood through which its line passes. It is "good business" in the highest sense to make improvements which appeal to the good will of the community in which a firm or corporation operates.



STREET CAR PATRONS IN PASADENA APPRECIATE THESE ARTISTIC REST STATIONS

Electrical Treatment of Children

In the August issue mention was made of certain experiments in the stimulation of the growth of babies by means of high frequency currents. These were made by Mr. T. Thorne Baker, who frequently performs more or less spectacular "stunts" of this nature for his paper, *The Daily Mirror* of London. We now have a photograph and some further details of this interesting work to present.



CHILD IN AN ELECTRIFIED CAGE

The experiments have been conducted in some cases with his own little daughter of five, Yvonne Baker. These experiments, says Mr. Baker, are the first of their kind, and he now expects shortly, in conjunction with a medical man, to start treating the first of the babies who really need the treatment—babies who are thin, anemic and underweight.

Seated in a grim looking cage surrounded with wires, little Yvonne Baker underwent for five minutes recently the high-frequency, electro-magnetic treatment, and at the same time "sat" for her photograph. One's imagination was stimulated by the wire cage, the crackling blue sparks from the giant coil, the sense of mystery and unknown power which the apparatus radiated. What would an old-fashioned mother have thought could she have seen this modern method of strengthening babies?

Little Yvonne, after the experiment, gave her impressions to the photographer. While she was in the cage her father put in a helium vacuum tube, and it glowed brightly, showing the electrified atmosphere. "I felt lovely all the time," said Yvonne. "It made me feel very happy. I should have liked to go to sleep there, it was so comfortable. I love having 'lectric currents." Really she felt nothing at all, but she imagined all this.

There is no pain or danger in the treatment. The babies will be placed in a cot in the wired in cage for ten minutes each day. The doctor will weigh them and carefully report upon their progress. In the cage electro-magnetic waves are set up in the ether, these waves moving in all directions hundreds of thousands of times a second. "Laboratory experiments have shown me," says Mr. Baker, "that these currents improve the circulation of the blood and therefore increase the vitality of the infant under treatment."

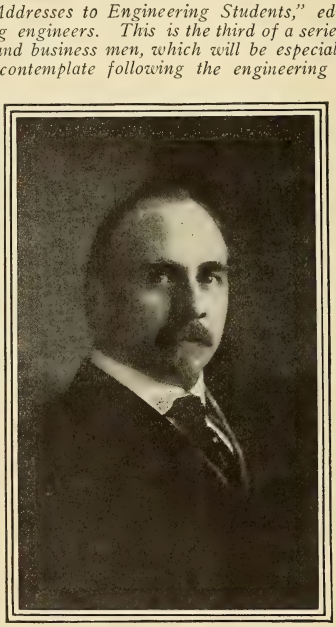
Outdoor Electric Advertising

No other form of outdoor advertising is at present so free from criticism and antagonism from esthetic reform organizations as electric advertising. On civic grounds electric advertising is generally recognized as highly desirable. It is the one advertising medium which at the same time serves a distinct commercial service and renders a distinct public service in lighting the thoroughfare.

College Training of Electrical Engineers

By A. C. SCOTT, President of the Scott Engineering Company

Extracts from "Addresses to Engineering Students," edited by Waddell and Harrington, consulting engineers. This is the third of a series of similar articles by prominent educators and business men, which will be especially interesting to boys and young men who contemplate following the engineering profession.—Editorial Note.



Lord Kelvin said that the first object of an education is "to enable a man to live," and the second, "to assist other men to live." The truthfulness of this statement is nowhere more apparent than when considered with respect to the engineer of the present time; to him is due, more than to any other, the great improvements in communication, transportation, illumination, and sanitation, which so manifestly assist other men to live. Moreover, it must be admitted that the phenomenal advance made in electrical engineering within the past few years has brought comforts and luxuries to the public at large never before considered possible.

It has been well said that "the recent rapid development of the electrical industry owes its vitality to the engineering school. Its graduates have done the designing, constructing, operating, and directing which have made possible the rapid progress and wise extension in the use of electricity."

Granting that this is true, the questions of vital interest and importance at present are:

Does the average university or college technical school properly prepare its students for their life work as engineers?

Does the sequence of courses taught, and do the methods of teaching afford the maximum opportunity for the student, when viewed from a common meeting point of the psychological and pedagogical standards within the college, and the practical or operating standards outside it?

Such questions as these, or something akin to them, have of late been the source of voluminous and no doubt profitable discussion, although a digest of papers recently published appears to show that no common ground of agreement has yet been reached.

A few years ago the manufacturers and heads of corporations gave the college graduate but little encouragement, because they did not appreciate the value of concentrated theory; the probable reason why today they are saying, "Give us technically educated men," and are filling vacancies in their factories and systems with college men, is on the one hand that the college is constantly endeavoring to improve methods of instruc-

tion, including such practical testing and laboratory work as will be more in line with their requirements, and on the other, the manufacturer or corporation manager is becoming educated to recognize the importance of sound theoretical training.

The most potent criticisms by large manufacturers and property managers of their college graduate employees, at the present time, appears to be that they lack a certain kind of human common sense, and that they do not know how to adapt themselves to new conditions, or to adjust their personalities to the wishes of their superiors; that they lack most decidedly the ability to direct men, and are loath to assume responsibility which requires originality or initiative on their part.

To meet such deficiencies, several of the large concerns have established special apprenticeship courses, and it has recently been shown that with one large company, of those who finished the apprenticeship course, 50 per cent are now with the company, and the others are with operating or electrical supply companies, or are acting as consulting engineers or instructors.

The apprenticeship course attests the validity of the criticism, but there are grades of adverse criticism, and it appears that the sort presented is the best, for the following reason: A student passes from three or four years of cramming, memorizing effort, in the high school. During the first two years of his college course he is likely to go on memorizing as in the high school, and does not really learn how to study or concentrate his mind on the work before him until some time during the junior year, or possibly the senior year. As a matter of fact, it appears that there is not sufficient time for him to obtain a knowledge of the fundamental principles underlying a broad education in engineering, and at the same time carry on work involving much originality, or the direction of men. Therefore, the criticism of the manufacturers in general of college graduates is what one familiar with professional college work might expect. There appears to be no doubt, however, in the minds of all that fundamental principles of mathematics, mechanics, physics, chemistry, English, foreign languages and political science are a necessary part of the engineering graduate's proper training, as well as the more specialized subjects of engineering.

I am thoroughly of the opinion, therefore, that the average technical college does not properly prepare students for their future work as electrical engineers. The chief reason is that an attempt is made to complete subjects in a four-year course which, if properly taught, would require fully six years. It is no wonder the student does not develop the spirit of original research—he has no time to do anything but attend lectures in the morning and laboratory practice in the afternoon for six days per week, and even at that pace does not properly cover the ground. The electrical engineer must be more of an all-round engineer than any other; he must not only have the fundamental knowledge of theoretical and applied electricity, but in addition must be reasonably familiar with much of civil, steam, hydraulic and gas engineering.

With the ever-increasing additions to the present great store of technical knowledge, I have no hesitancy in expressing my belief that the institutions that are in the lead with a five or six year technical course will readily find better positions for graduates than will the others. It certainly appears reasonable that in an institution having well-equipped laboratories and a corps of competent instructors, it is possible for the student during the one or two extra years to do much more for himself than would be possible in the same time after leaving at the end of a four year course with what amounts to a too hastily swallowed dose of everything taken: this is evidenced not infrequently by cases of acute mental indigestion and, as complained of

by the manufacturers, an utter lack of originality, judgment, or logic in meeting shop requirements.

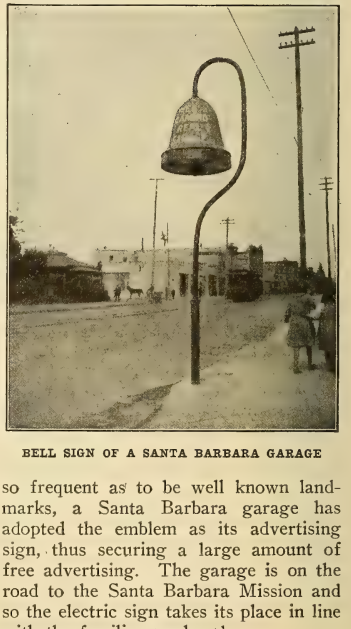
The longer course gives the student time for some attention to athletics, social functions, perusal of current engineering literature, a better training in culture subjects, and a much more thorough training in theoretical and applied engineering, than a four year course. My view of the situation, considering the best interests of the students, is that any college offering technical courses leading to an electrical engineering degree should require the equivalent of a five year course to obtain the B. S. degree in electrical engineering, with the further provision that the E. E. degree be allowed for an additional year of study involving a thesis covering original research work; maintaining the standard entrance requirements as at present and the same for all students.

So far as laboratory courses are concerned, I believe it to be possible to meet the criticisms of employers of students to some extent. In some of the engineering laboratories the students have nearly all connections made for them, and their chief duty one and all in a test is to read instruments and record their readings. I think that is the limit of poor laboratory instruction. The student regards it as a special dispensation at the time, but if he is required to direct a shop test later on, he will no doubt act as though devoid of "human common sense." He does not know what to do, much less how to direct others. The laboratory course that will most nearly meet the adverse criticism of employers today is the one wherein the students are required to make all machine and instrument connections, and also that requires some one of the members of a section to act as director of the test at every period, and be responsible to a reasonable extent for the use of machines and instruments. This arrangement is not intended to relieve the instructor from his duties in the least; on the contrary, it may add something to them, for the student whose turn it may be to direct the test should confer with him beforehand in order to be sure that he understands the test completely, and also to learn what instruments are available for the test.

It is only by actually directing men that one learns how to do it, and if the students gain some practice in this way in the laboratory they may be less criticised after entering practical work.

Unique Electric Sign

The huge bell of green glass shown in this illustration is a duplicate on a large scale of the bronze Mission bells which have been set up at frequent intervals on the highway which links the old Spanish missions in California, a popular automobile road known as El Camino Real, or the King's Highway. As these signs are

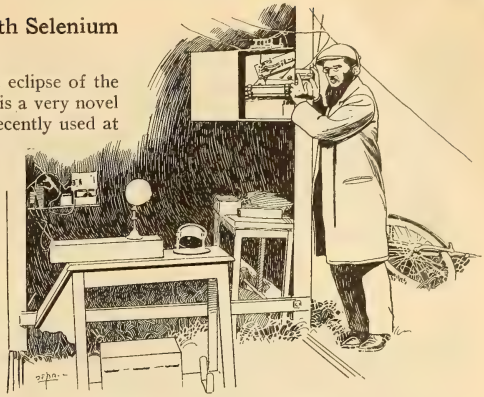


BELL SIGN OF A SANTA BARBARA GARAGE

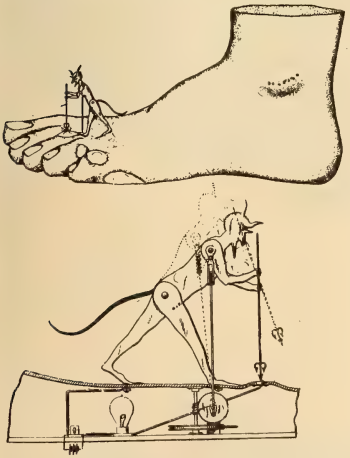
so frequent as to be well known landmarks, a Santa Barbara garage has adopted the emblem as its advertising sign, thus securing a large amount of free advertising. The garage is on the road to the Santa Barbara Mission and so the electric sign takes its place in line with the familiar roadmarks.

Recording Eclipse with Selenium Cell

Taking the effect of the eclipse of the sun by means of selenium is a very novel method which M. Ancel recently used at Paris. Seeing that more or less current will pass through a selenium cell according to the amount of light falling upon it, he applied the idea by throwing the sun's rays upon a very sensitive cell and measuring the effect of the light by recording electrical instruments. This he was able to carry out with good success in the suburbs, where he had erected a shelter tent in the middle of the fields. In front of the tent was a mirror moved by clockwork, so that it followed the sun exactly and kept its light thrown upon the selenium cell, this being placed on a table at the front of the tent. Inside was set up the electric recording apparatus and batteries. The recorder worked upon a moving paper band and traced a line showing the strength of the light.



RECORDING AN ECLIPSE WITH SELENIUM CELL



HOW ONE MIGHT SUPPOSE THE STING OF A CORN IS PRODUCED

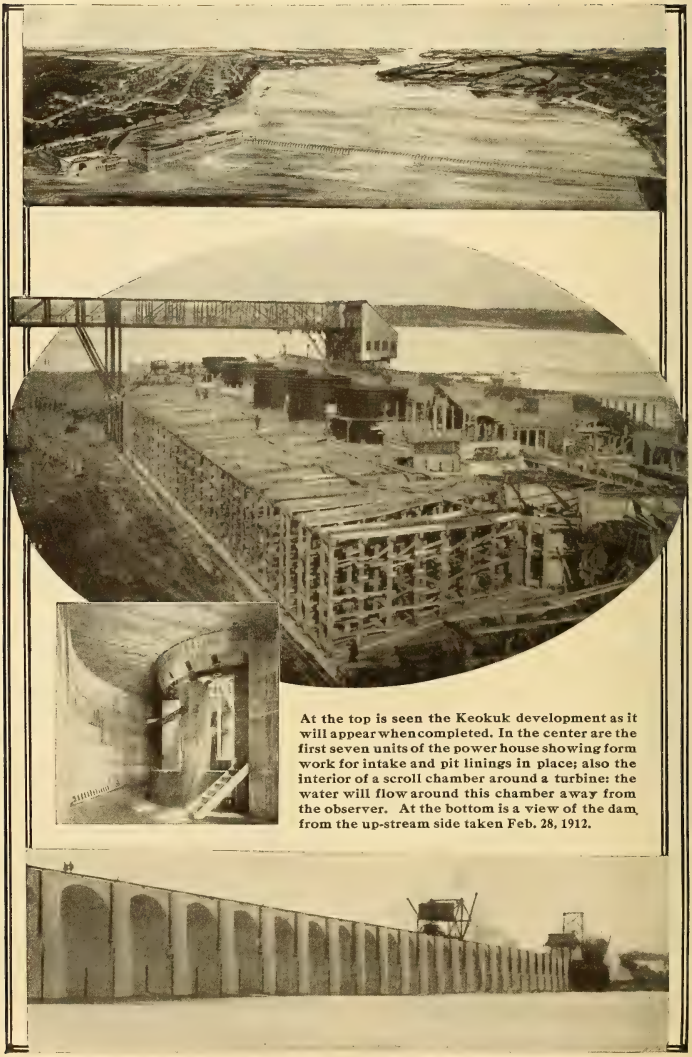
Corn Cure Advertising Device

An unusual advertising device for calling attention to a corn cure is the subject of a patent issued to John Jay Lepper, Milwaukee, Wis.

A hollow member representing a person's foot is surmounted by a moving figure representing his Satanic Majesty. In his hand is a spear. With great regularity he brings the point of the spear down upon an offending corn, when, upon withdrawing it, an electric spark is produced between the corn and the spear point. Within the foot form is a small motor and a lamp.

Boron in Cast Copper

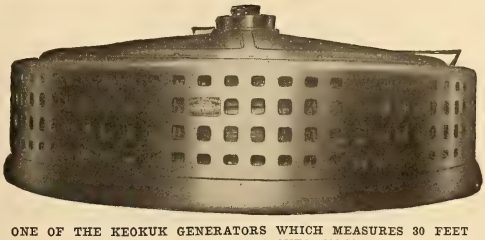
Recently a step of great importance has been made in the casting of copper. It was formerly impossible to obtain a cast copper having the density and electrical conductivity of the drawn pure copper. Now, through the use of boron, copper may be cast of high conductivity, high density and freedom from blow holes.



At the top is seen the Keokuk development as it will appear when completed. In the center are the first seven units of the power house showing form work for intake and pit linings in place; also the interior of a scroll chamber around a turbine: the water will flow around this chamber away from the observer. At the bottom is a view of the dam from the up-stream side taken Feb. 28, 1912.

Immense Generators of the Keokuk Plant

The largest power house in the world, where will be wrested from the "Father of Waters" the largest single conservation of energy ever harnessed, will be installed ultimately 30 immense vertical waterwheel type alternating current generators that rank as mammoths among machines for generating electric current. These generators will be placed in the hydro-electric power house at Keokuk, Ia. When completed this building will measure 1,750 feet long by 123 feet wide by 133 feet high above the foundations, and the plant will develop with the final entire installation over 300,000 horsepower. This gigantic concentration of energy is to reach out and wrestle with the machinery, lighting and traffic of towns and cities within a zone of 150 miles or more from Keokuk.



ONE OF THE KEOKUK GENERATORS WHICH MEASURES 30 FEET IN DIAMETER AND WEIGHS OVER 600,000 POUNDS

In the March issue of this magazine an article of some length treated of this immense project. Some later pictures have been received, however, showing the present stage of the development, which are reproduced on the opposite page. Also, a little additional information concerning the gigantic dynamos or generators will be of interest.

The initial installation of electric generating units, built by the General Electric Company, will include fifteen alternators direct connected to the same number of vertical hydraulic reaction turbines of the single runner type, which will occupy the north half of the power station. Each turbine and generator will form an independent unit. Each wheel, mounted on a vertical shaft 25 inches in diameter, in a spiral chamber 21 feet three inches in diameter and molded in the concrete substructure, will operate at a constant speed of 57.7 revolutions per minute and will have a normal capacity of 10,000 horsepower.

The generators are to be installed on top the wheel pits directly over the turbines and will be direct connected to the vertical wheel shafts by forged steel flanged couplings.

The rotors of the generators operating at slow speed accounts in a measure for the great size of the machines at their rated capacity, as will readily be understood by engineers. The generators measure 32 feet in diameter by twelve feet high, and the total weight of each machine is over 600,000 pounds. Fifteen to 20 freight cars are required to transport one complete generator when dismantled, the shipping weight of which is nearly 700,000 pounds. About 400 cars and 25 locomotives will be needed to haul the shipment of the entire equipment of electrical apparatus for the first half of the installation. These cars and locomotives all coupled together would form a train 4¾ miles long.

Notwithstanding the moderate speed of the generator rotor, owing to its great diameter the peripheral velocity is relatively high. Should a fly crawl in onto the outside of the rotor and it start suddenly, he would be whirled around at

the rate of 52½ miles per hour, provided he could hang on. Walking on the ceiling is an everyday occupation for the fly, but hanging on a merry-go-round where the centrifugal force tending to throw him off would amount to nearly 500 pounds is not usually included in the fly's stock of legerdemain. He might as well try to carry a fat man on his back.

Ohio Electric Light Association

Ohio has been called the "Mother of Presidents," so many of the nation's executives have come from this state. Ohio never does things by halves and the Ohio Electric Light Association convention at Cedar Point, July 16 to 19, was a sample of some of the state's energy active in the electrical field.

The membership is made up of men connected with the electric light and power plants, large and small, scattered over the state. This year they elected as their president Mr. J. C. Martin, of Wilmington, Ohio, to succeed Mr. W. C. Anderson, of Canton.

Only twelve years after the first commercial central station was built in Appleton, Wis., in 1882, the Ohio association was formed, making it easily a pioneer among the many strong state associations which grew up later. No small portion of its success has been due to its secretary-treasurer, Mr. D. L. Gaskill, who has held the position for many years.

That the farmer can make profitable use of electricity was evidenced in one paper, "Electricity in Rural Districts," by J. C. Matthieu, of the Dayton Light and Power Company.

"The possibilities of electricity on the farm have not as yet been scratched," says Mr. Matthieu. "The farmer is one of the first to adopt modern practice if he is but shown. Irrigation is destined to become one of the most important, if not the most important, economic factors of the country; water, when and where you want it, will act as a governor regulating that great machine—the farm.

"In the state of Ohio there are an innumerable number of truck farms where success depends a great deal upon the amount of rain that falls each month and at the proper time. Truck garden crops demand even distribution of from one to five inches of water per month. Rainfall estimated over six months for a period of 28 years throughout Ohio is approximately 3¼ inches per month, an excess precipitation often following a period of drought and vice versa.

"Experience has shown a crop increase of from 25 to 100 per cent with plentiful

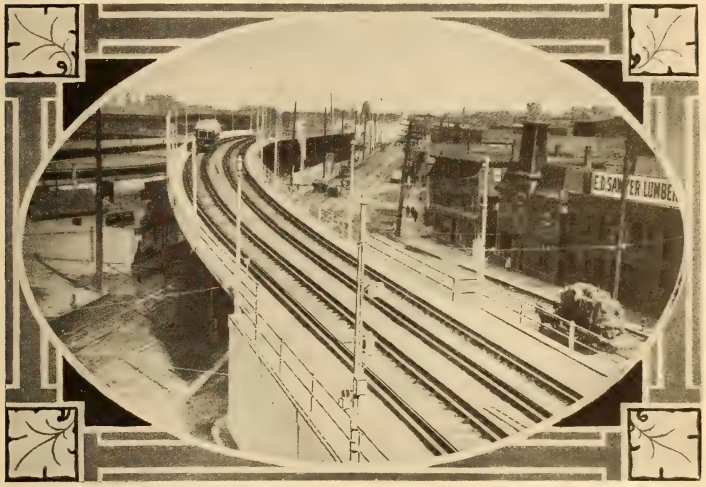
D. L. GASKILL

wetting of the ground at plant setting and regularly applied irrigation of two or three inches of water per week in one to three applications, depending upon the weather and rainfall.

"In some instances motors are used to increase circulation of the water in heating pipes in greenhouses, thereby saving the coal bill. The very fact that the pump can be left without an attendant, running at any hour of the day, is what appeals to the farmer. And he can use a portable motor upon feed grinders, hay presses, silage grinders, threshing machine, corn shellers, etc.

Surface Cars on an Elevated Line

There has recently been opened in Boston another section of the fast growing rapid transit system of the city, under the control of the Boston Elevated Railway Company. This is the East Cambridge elevated extension, which is a double tracked elevated structure for surface cars only, the cars being specially built heavy steel conveyances of the familiar trolley type, with sliding end doors controlled from either end, and having concrete floors. This line extends from Lechmere Square, East Cambridge, through the West End of Boston to the North Station, where it connects with the elevated and subway systems.



Copyright by Boston Photo News Co.

BOSTON'S NEW ELEVATED TROLLEY LINE—CHARLES STREET CURVE—SHOWING CONCRETE VIADUCT IN DISTANCE

It was built under the direction of George A. Kimball, chief engineer of elevated and subway construction, by the Boston Elevated Company. It is 1.18 miles in length and has 2.51 miles of single track. It crosses the Charles River on an ornamental concrete viaduct about 1,700 feet long, said to be the longest concrete bridge in the country. Near the Boston end is a Strauss trunnion bascule drawbridge, electrically operated.

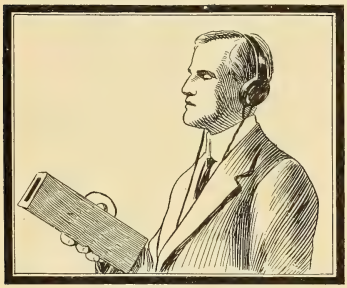
By means of automatic interlocking devices, steel bumpers are raised from between the rails of each track, eliminating danger from the car approaching an open draw. The bridge, therefore, cannot be raised unless signals are set at danger and bumpers are raised to protective positions. Except for the portion over the river, this elevated trolley structure has a concrete floor and the track, of 85 pound A. S. C. E. tee rail, is laid in rock ballast. The cost, exclusive of power, cars, etc., was $3,500,000.

One very interesting feature of the viaduct structure is the huge hinge that is embedded at the base of every arch where the span rests upon the pier. Fully five feet wide and nearly six feet tall, these hinges are intended to take up the motion of expansion and contraction of the huge

mass of reinforced concrete in each arch. That these are the hardest hinges to move that have ever been conceived may be seen from the fact that the steel pin which joins the two leaves of the hinge can support 2,000,000 pounds and this weight is necessary to move the hinge a half inch.

Scientists Listen to Light's Noises

Great interest has been aroused in scientific circles by the exhibition at the optical convention held recently in South



PROF. D'ALBE'S APPARATUS

Kensington of the octophone, an instrument which makes light audible. It is the invention of Prof. E. E. Fournier d'Albe, B. Sc., M. R. I. A., lecturer on physics at the University of Birmingham, formerly secretary of the Dublin Society for Psychical Research.

The octophone is a cameralike box from which come two wires with highly sensitive receivers at the ends. If you are blindfolded and place the receivers to your ears and a piece of blotting paper is placed between the box and an arc lamp you hear a ticking or grating sound —in fact, you "hear" the shadow passing. On a moonlight night one may hear the moon, while the sun makes a tremendous noise like a cataract.

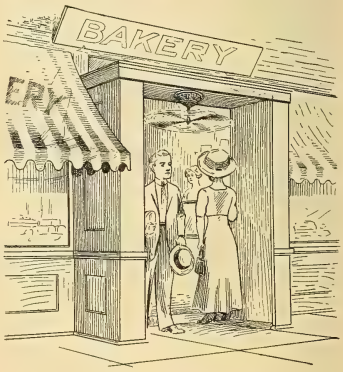
The octophone can locate the light of stars invisible through the telescope.

A stone blind young man stood with the receivers to his ears. Between him and the windows people passed at intervals. He always detected their passing, exclaiming, "That's a man!" Walking with the instrument, he always found a window by the noise caused by the light, although he lives in perfect darkness.

Prof. d'Albe hopes his discovery can be greatly utilized for the benefit of the totally blind.—Dr. Leonard Keene Hirschberg.

Flies Avoid Fan Breeze

The electric ceiling can be recommended without qualification as a substitute for a screen door. Flies plainly show their dislike for the breeze from a fan, and this has led bakeries, restaurants and candy stores to appropriate the

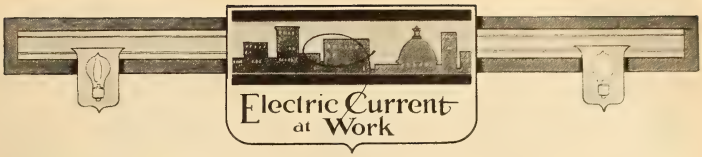


FANS KEEP OUT THE FLIES

idea. One very serviceable place to install the fan is at the ceiling of the entrance to the store.

Electric Line Up Mt. Washington

Plans have been completed by the Boston & Maine Railroad for a unique summer hotel to be erected on the summit of Mount Washington, and to be reached by a scenic electric railway almost 20 miles long, which will circle the mountain 2½ times.



The Electro-Magnet a Veritable Aladdin's Lamp

By GEO. J. KIRCHGASSER

In the early part of the nineteenth century—1820, to be more exact—it was discovered that a bar or rod of iron could be magnetized by passing an electric current through a coil or spiral of wire surrounding the bar or rod. This results in an electro-magnet, developments of which are responsible for our great industrial advances. The electro-magnet is the basis of modern electrical industry. Electrical investigators in all branches have produced marvels since the discovery of the electro-magnet.

Morse made all of us kin when he adapted the electro-magnet to the telegraph. Bell made whispering galleries of the country by adapting another form of electro-magnet to produce the telephone. When you go calling an electro-magnet, actuated by the small push button, announces your coming.

The electric telegraph consists simply of an electro-magnet placed at a receiving station, the iron bar core of which is attracted, making a clicking noise each time a small hand switch or key is closed at a sending station. The clicks of the iron core, translated by the Morse code, transmit the message.

The dynamo or generator which produces the electric current for the lighting of our homes, offices, stores, etc., and the motors for operating our streets cars and the machines of our factories, consists essentially of two electro-magnets, the rotating armature and the stationary field poles being usually built of sheet steel or iron around which insulated wires or conductors are placed.

As late as the year 1895 the prospect of adapting the motor widely for industrial purposes seemed slight. At that time it would have been ridiculous to predict its almost universal present day application. An electro-magnet, a very small one, was again mainly responsible for making the motor generally applicable. Before Mr. Harry H. Blades invented the adaption of the "no-voltage release electro-magnet" with the starting rheostat of the motor all sorts of dangers were concerned with every motor installation. They were liable to burn out, to run away and to fly to pieces.

The design of Mr. Blades, which is adapted universally now, is illustrated in Fig. 1. Here the electro-magnet referred to is seen at the right side and consists of a spool wound with a coil of small wire. This winding is connected in circuit with the wires which carry current to the field coils of the motor and when current passes through it the iron pieces seen at the ends of the spool become strong magnets. The handle at the left is for starting the motor gradually, as it passes over the contact buttons. In its extreme right or "full on" position the electro-magnet grasps and holds the lever against the action of a spring. As long as everything is all right and current flowing to the motor the electro-magnet holds the lever in the "full on" position. If the current is accidentally cut off the

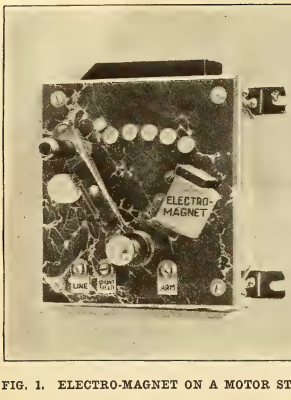


FIG. 1. ELECTRO-MAGNET ON A MOTOR STARTER

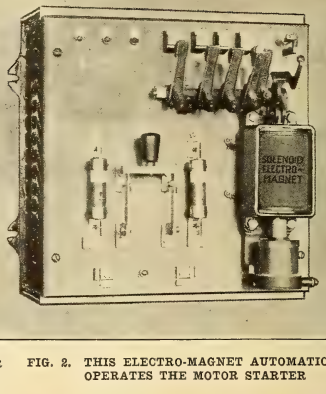


FIG. 2. THIS ELECTRO-MAGNET AUTOMATICALLY OPERATES THE MOTOR STARTER

electro-magnet is de-energized and lets go of the lever, which flies back to the "off" position. Then, when the current comes on to the line again the motor will not start until the lever is thrown over by an attendant slowly, from button to button, so as not to allow a rush of current through the motor and burn it out. This device, small as it may seem, has meant more to the application of motor drive than anything else.

Besides its use on the simple hand operated motor starters, the electro-magnet has been adapted in various designs to all kinds of motor controlling devices. Fig. 2 shows an automatic motor starter or self-starter, the principal feature of which is the electro-magnet mounted on the right side. Small wires which control the current to the electro-magnet can be carried to any or several points, and permit, by simply pushing a button or closing a small switch, of starting the motor from a distant place. This is called remote control. The magnet pulls up its iron core, which is retarded by an air dash-pot in this case, and closes the successive fingers at the top of the panel and brings the motor from rest to full speed. If the current supply is interrupted the magnetized core drops down and opens the finger contacts.

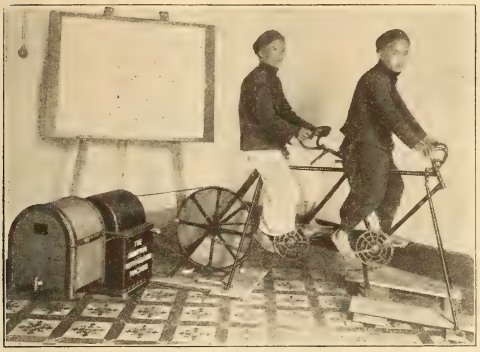
The high speed electric elevators required in our tall buildings are possible only through the agency of the electro-magnet. The elevator car is not started, speeded up and stopped directly by the operator's switch, but by a series of electro-magnetically operated switches located on the elevator controller near the motor. The operator's switch carries the current to the magnetic switches and they handle the main currents.

The adaption of the electro-magnet permits of the high speed, easily controlled printing press. The controller may be located on the wall, and push button stations permit of starting, speeding up, slowing down, stopping, etc., at the will of the operator. These stations simply close or open small circuits which energize or de-energize the electro-magnets or electro-magnetic switches of the controller which govern the action of the motor driving the press.

The above examples of applications are only a few out of a multitude, but these show that the electro-magnet responds to the various purposes for which the electrical engineer wishes to use it. It is not only necessary to the dynamos and motors, but is the basis of the entire industry of motor controllers—it has been a veritable Aladdin's Lamp.

Audiffren Refrigerating Machine

The Audiffren refrigerating machine operates on the compression system, using sulphur dioxide as the refrigerating agent. It consists of two globes joined by a hollow shaft which carries on its extension a pulley or crank. Its external appearance is that of a dumb-bell. There are no joints, valves, gauges or stuffing boxes, and its operation is simplicity itself. It is only necessary to place the machine in its bearings, fill the condenser and refrigerator tanks with water and apply the power, in order to have at will, within a few minutes, cold air, cooled water or ice.

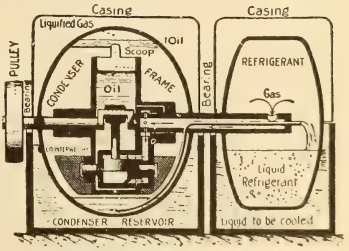


METHOD OF OPERATION IN INDIA WHERE ELECTRICITY IS NOT ALWAYS AVAILABLE

A pump, the compressor, receives and compresses a liquefiable gas, in this case sulphur dioxide, and discharges it into the condenser, where liquefaction takes place, the metallic container being cooled by the water in which it is partly immersed. The resulting liquid passes through the hollow shaft into the refrigerator, where it expands again into a gas and is ready for its return to the compressor. The circulation of the volatile liquid continues in a closed cycle from the condenser to the refrigerating side and return indefinitely. One of the most novel features of this machine consists in making the compressor operate in the atmosphere which it compresses, inside of a condenser hermetically sealed.

An electric motor is the most practical and convenient means of supplying the power and is used where it is available. In India, where electric power is not everywhere available, the machine is connected by chain to a tandem bicycle operated by coolies. The particular machine set up in India is used to make ice for drinking water and for table purposes. This application of the Audiffren refrigerating machine in the Orient is merely an extension of the activities of the punkah boy and his fan.

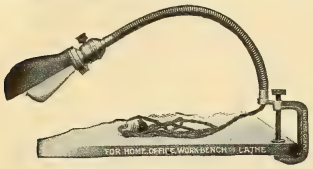
When the Audiffren machines are applied to domestic refrigeration in other countries, they are mounted directly on top of the refrigerator, and brine is used in the cold tank instead of water. Connections are made from the brine tank down to the cooling surfaces placed in the ice box. In this way the refrigerator is cooled by clean, dry, pure air and the disagreeable slime, which is bound to collect from even the best ice, is avoided.



SHOWING THE ACTION OF THE AUDRIFFEN REFRIGERATOR

Flexible Lamp Arm

A handy lamp holder for the garage, work bench, lathe, etc., is here shown. A flexible arm is attached to a bronze

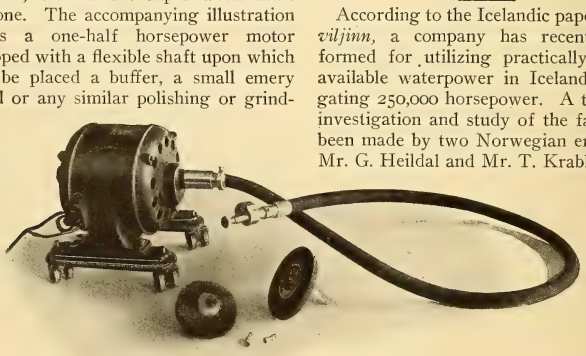


FLEXIBLE LAMP ARM

clamp that makes it possible to fasten the whole outfit to a bench, table or any material over which the three inch jaw of the clamp will fit. From the plug the cord passes through the interior of the arm up to the lamp.

Portable Polishing and Grinding Motor

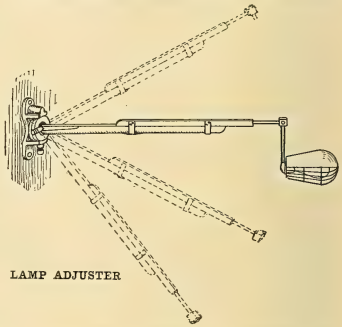
In the grinding and polishing of metal, the electric motor enters as a strong competitor of the hand method, especially if close, careful but rapid work must be done. The accompanying illustration shows a one-half horsepower motor equipped with a flexible shaft upon which may be placed a buffer, a small emery wheel or any similar polishing or grinding device. The flexible shaft makes it possible to keep the material worked upon stationary. The motor runs at 1,750 revolutions per minute.



PORTABLE POLISHING AND GRINDING MOTOR

Lamp Adjuster

This illustration shows the Universal lamp adjuster designed to be fastened to the wall or ceiling at the point where a movable light is required. The arm is of polished hard wood and the trimmings



LAMP ADJUSTER

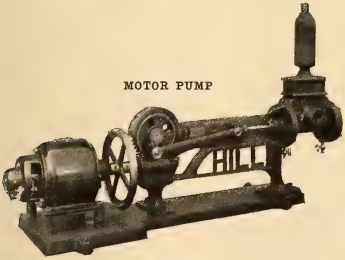
are aluminum finished. A reflector and wire guard make the adjuster very serviceable in the shop or factory.

Water Power of Iceland

According to the Icelandic paper *Thödviljinn,* a company has recently been formed for utilizing practically all the available waterpower in Iceland, aggregating 250,000 horsepower. A thorough investigation and study of the falls have been made by two Norwegian engineers, Mr. G. Heildal and Mr. T. Krabbe. The name of the company is the Iceland Waterfalls Company, Ltd. The president is Mr. Sam. Johnson, Christiania, Norway.

Reciprocating Motor Pump

A novel form of electric house pump is shown in the accompanying illustration operated by a small electric motor



MOTOR PUMP

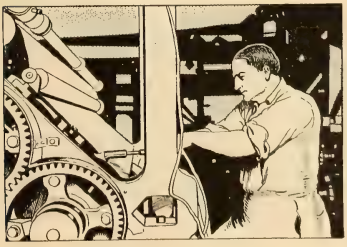
of a semi-enclosed, direct current type developing ¼ horsepower. A piston pump is utilized with a connecting rod operated by the armature shaft of the electric motor through a transmission of worm gearing.

The Electric Felting Tool

When a newspaper is being printed, the paper is run on the press over a strip of muslin, and beneath the muslin is a felt "blanket." In a short time the constant pressure of the inked metal wears down the felt, leaving in the center, at the ends of the metal, a ridge of felt, which corresponds to the unprinted margin at the center of the newspaper, where it is folded. If this narrow strip of felt, or "bolster," as it is called, is not kept down to the level of the blanket the paper will crease or even break at the margin.

Before the electric felting tool was put on the market it was necessary to scrape the bolster or burn it down with an ordinary soldering iron. By either method the process was a slow and laborious one, sometimes requiring a man on each side of the cylinder.

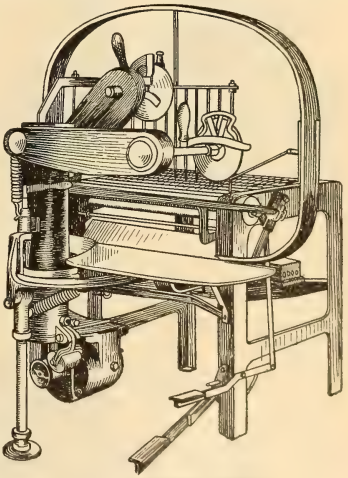
In cases where the Vulcan tool has been adopted it is said that very few minutes are needed for burning the bolster with the new iron, and that, as it may be kept at an even temperature, it has not the destructive effects of the old soldering iron or scraping knife.



USING THE FELTING TOOL

Electric Meat Cutter

The machine illustrated is a motor driven meat cutter made to slice up beef loins and rounds into nice, even steaks.



ELECTRIC MEAT CUTTER

It works rapidly and takes the place of the knife and saw in the retailing of all sliced meat. It is operated by a one horsepower motor, and its working parts are made of nickel plated steel.

An Electric Scrubbing Machine

An interesting machine has just been patented by E. J. Stewart, an attendant at the Vanderbilt Clinic in New York. It is an automatic electric scrubbing machine which supplies water to the floor, scrubs it and takes up the dirty water as the apparatus is pushed forward or backward.

ELECTRIC SCRUBBING MACHINE

The machine has a tank holding about five gallons of water, which is poured into it through the funnel on top. It then runs from the lower corner through a valve to a sprinkling pipe in front of a revolving brush, the flow being regulated by a lever on the handle. Under the tank is a small electric motor (¼ horsepower) which turns the brush at a speed of about 400 revolutions a minute. The brush is seven inches in diameter, so its bristles travel about 700 feet a minute, sweeping up the water into detachable receptacles.

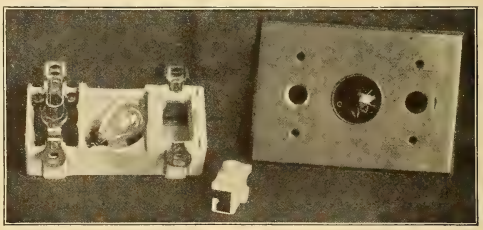
By a simple system of gears the brush can be adjusted so as to press lightly or strongly against the floor, and thus can be used effectively until it is worn out.

The machine works the same in either direction, thus obviating the necessity of turning it around. When the wall has been reached, all that is necessary is to swing the handle over. This reverses the action of the motor and of the brush and shuts off the water on one side and turns it on on the other. This keeps the bristles straight.

Telltale Lamp for Heaters and Irons

Because the electric heater or iron gives out no light or flame we may sometimes forget to turn off the current. It is therefore desirable to have between the heater or pressing iron and the switch an incandescent lamp of low candlepower to show at a glance whether or not the current is on.

This idea is carried out in the Bryant combination receptacle, which contains a push button switch, a place to put in the heater plug, and between the two a pocket in the porcelain in which an incandescent lamp is held by clips. This all sets back flush in an iron box in the wall just over the ironing board or

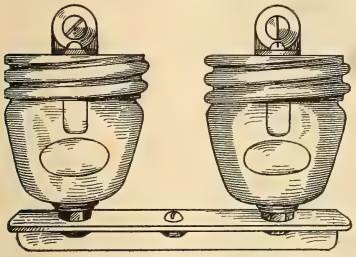


LAMP INDICATOR FOR ELECTRIC HEATER CIRCUITS

heater, and is covered by a neat brass plate with a red glass bull's eye over the telltale lamp.

Mercury Lightning Arrester

This odd looking mechanism is a lightning arrester designed for service upon telephone circuits. A heavy glass cup is secured by a machine screw to an aluminum base which is connected to ground. Over the head of this screw in the base of the cup mercury is placed. A substantial screw cap or cover serves as a means for connecting to the line wires, while from the center of the cover a carbon post projects down to a point close to the mercury. When the line is struck by lightning the high voltage tends to draw the mercury up to the carbon post, closing the air gap and completing the circuit to earth. The mercury remains in contact with the carbon until the discharge has passed and then drops back to its normal position, restoring the air gap and ready for another stroke.



MERCURY LIGHTNING ARRESTER

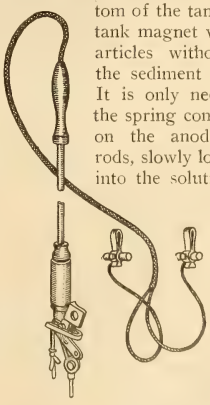
The Flexalite Candle

Although a very attractive illumination is given by an electric candle, there are many drawbacks to the use of this kind of light, and one of the chief objections is the difficulty of having a good fit of the candle into the socket. Again, it is liable to break in ordinary household work, and where the candle and electric lamp are all in one piece, the whole is made useless when the lamp burns out. In England the Sun Electric Company makes what is called the Flexalite candle and it overcomes these drawbacks. The fitting has a small lamp separate from the candle tube, so that a new lamp can be put in. The base is made with a spring plug so that it will fit into any candle holder. One of the main points which will appeal to householders is that the spring base prevents accidents when dusting is being done, as the spring makes the candle bend over, and it comes back again in the straight position so that no breaking is feared. Another point is that it faithfully reproduces the graduating transparency of the candle.

FLEXALITE CANDLE

Plater's Tank Magnet

Every plater knows the annoyance caused when articles are lost at the bottom of the tank. The plater's tank magnet will recover lost articles without stirring up the sediment in the solution. It is only necessary to snap the spring connectors in place on the anode and cathode rods, slowly lower the magnet into the solution and recover the lost piece or pieces, then gently withdraw the magnet. Work in the process of plating is not disturbed. Magnets are made up in three styles to suit the three voltages common in plating shops.



Electrical Men of the Times

WALDO ARNOLD LAYMAN

That a good newspaper man will make a good engineering executive is shown by the career of Waldo Arnold Layman, vice president and manager of the Wagner Electric Manufacturing Company, of St. Louis. Mr. Layman's newspaper activities began while he was still in the sophomore class of the Terre Haute (Ind.) high school, from which he graduated in 1887, at the age of eighteen. There he established a monthly paper for the school, running it as a private enterprise until graduation time.

His connection with this high school journal resulted in an invitation to devote a summer vacation, between junior and senior high school years, to work as a member of the editorial staff of the Terre Haute *Daily Express.* This he accepted and served through the summer vacation as a reporter. The work of that summer resulted in an offer immediately after graduation of a permanent position on the editorial staff of the *Express,* as assistant to the city editor, and in that capacity Mr. Layman served from about June, 1887, to September, 1888.

Following this, Mr. Layman accepted the position of editor of a weekly family paper in Terre Haute, called the *Saturday Evening Mail.* This was one of the successful family weeklies in that section of the country and had a wide circulation. Mr. Layman remained there until he decided to enter Rose Polytechnic Institute, having been influenced to do so by Dr. T. C. Mendenhall, with whom he enjoyed a delightful acquaintance. The latter became much interested in Mr. Layman and agreed to make special arrangements for him by which he was permitted to continue his outside newspaper work.

Accordingly, he made arrangements to enter Rose Polytechnic Institute in September, 1888, continuing his direction of the *Saturday Evening Mail* at the same time for about two years, until the ownership of the paper changed. Then he resumed his relations with the Terre Haute *Daily Express* and continued to act as a contributor to that journal until about the middle of his senior year at college, giving up at that time so as to finish up the heavy work of his last college year. His newspaper work thus enabled him to make a fairly comfortable income for about three and a half years of his college course.

While at Rose Institute, Mr. Layman, with his pronounced newspaper inclinations, established a monthly college paper and was its editor during his whole four year term. He was also active in athletics throughout the course, taking a prominent part in the Institute's baseball programme. He was a member of the Rose Polytechnic track team, and held the Indiana 100 yard dash college championship for two years, the standing high jump record for three years and the run-

ning high jump record also for three years.

A year college book called *"The Modulus"* was also established by Mr. Layman while at Rose Polytechnic, and he was the editor of the first volume. Both this book and the other publication known as *"The Rose Technic"* have since been continued regularly as Rose publications.

Mr. Layman graduated from the Institute in 1892, with the degree of B. S., receiving a later degree of M. S. in 1894, and still later degree of E. E. in 1899.

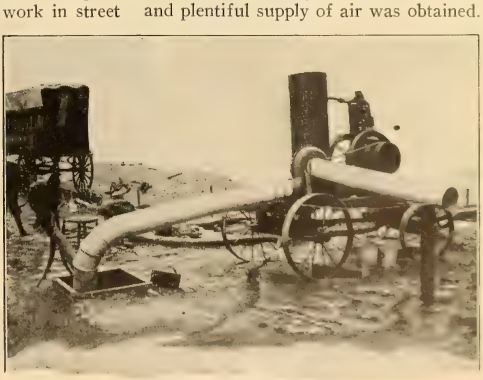
In 1892, shortly after graduation, he entered the employ of the Wagner Electric Manufacturing Company as a utility man in testing and drafting work. He made all the drawings for the Wagner company's first line of transformers and direct current motors, and became identified with all the work leading up to the development of a successful form of single phase motor. In 1894 he became assistant superintendent of the company, and still later, in 1898, he was given the position of assistant general manager. In 1900 he became treasurer of the company, and two years later was made general manager in addition. This twofold position he filled until 1908, when he was made first vice president and general manager.

His engineering work for the company for the last ten years has consisted chiefly in passing judgment on detail engineering work and in looking up new lines of engineering work. He has had full charge of the financial, engineering and manufacturing interests of the business since 1902. The entire Wagner organization is, at the present time, made up of men of his selection, including all the outside selling organization, with the exception of Mr. John Mustard, of the Philadelphia office. Mr. Mustard was out of the service of the company for one year, but was induced to return through Mr. Layman's instrumentality after he assumed the management of the business.

Providing Pure Air in Telephone Vault

Illuminating gas from leaky mains sometimes offers a serious handicap to doing repair or extension work in street telephone vaults. In one instance in Chicago recently fourteen men were affected and one rendered unconscious, a "pulmoter" (described in the May issue of POPULAR ELECTRICITY MAGAZINE) from the Commonwealth Edison Company being called upon to render assistance.

In seeking to remedy the trouble, hand forge blowers were tried without success. Finally an exhaust blower capable of handling 350 cubic feet of air per minute was mounted with a gasoline engine upon a truck. Sheet iron pipe was run into the vault and by this means a steady and plentiful supply of air was obtained.



PUMPING GAS FROM CABLE VAULTS

Electrical Interests of Women

EDITED BY GRACE T. HADLEY

A Woman's Artistic Work

The artistic and unusual work of Miss Leonide Lavaron, of Chicago, is attracting much attention. This French-American goldsmith has made many successful experiments in chemical processes, especially in the treatment of copper, one of the first metals used by mankind. There is scarcely a branch of human industry where copper is not an important factor. The "Lavaron copper" is noted for its color-play and iridescent surface. It was only natural that in working with the antique metal Miss Lavaron should study the classic urns, bowls and Pompeiian lamps of another age, in order to discover their structural principles, but she has evolved artistic new lamps which meet every modern need.

While traveling on the Pacific coast she one day picked up some sea shells, beautiful derelicts of the ocean. Holding them between the sun and her eye, this artist gratified her great love of color by studying the soft luster of the rainbow tinted light filtering through the shells. An idea occurred to her. Why not utilize the shells as globes in lamps made of Lavaron copper with an electric bulb as a miniature sun? Thus with the light which is so akin to sunlight, the

THE STUDIO OF MISS LAVARON, WHO DOES SOME WONDERFUL WORK WITH SHELLS

iridescent beauty of the shells might be produced at will. Upon returning home she polished a few shells and made her first shell globe lamp, which proved so successful that she began to import shells in quantities from Japan and the Pacific Islands.

Nature having furnished the idea for these lamps, the artist was careful to preserve the idea of life and growth in working out new effects in electric lamps. The first essential of any lamp is practical use and the Lavaron lamps afford excellent illumination in unique form; but they are wonderfully picturesque and often embody a deep sea motif, as for example, the lamp christened "Whispering of the Deep," in which a suggestion of life is most skillfully given to seaweed masses of copper forming the standard with globes of pearly tinted shells. A single trumpet conch fitted with a tungsten lamp and equipped with a copper standard makes a cozy corner lamp or furnishes sufficient light for a den.

Miss Lavaron has worked out a most charming effect in illumination in a vine-like fixture of copper and chitons for a conservatory or to be suspended across a glass door. The motif of the vine is the flowering maple with twisted copper stems, realistic leaves and tinted shells for the miniature lamp globes.

The Lavaron electric lamps show a decided departure from the conventional lamps and a return to Nature as the source of structural forms as these are revealed in the plant, the lily cluster or tangled seaweed. Miss Lavaron's combination of opalescent shells with copper and the tungsten lamp result in creations of exquisite color and luminosity.

The "House Electric" in Baltimore, Md., equipped at a cost of $10,000 by the Consolidated Gas & Electric Company, has a tea room where tea, cake and sandwiches are served free every afternoon from three to five, to ladies and customers.

An Illuminated Ice Box

Every user of an ice box will be interested in a refrigerator that not only embodies cold storage wisdom, but electric illumination. In the ice box illustrated by the accompanying cut an electric push button on the outside instantly illuminates the interior of the box. This

ILLUMINATED ICE BOX

has the advantage of lighting up dark corners and revealing at once the whereabouts of the butter or meat. When it was formerly necessary to illuminate the entire kitchen or pantry in order to see into the refrigerator, with this improved ice box it is only necessary to press a button and, behold, a flood of illumination just where it is wanted. This refrigerator is provided with an air flue at each end of ice chamber, affording a special system of circulation that prevents a pocket of foul air at top of provision chamber and gives a dry, cold atmosphere in every part of the storage compartment. This system of sanitation provides a hot water flushing device in connection with a syphon floor trap. Electric lamps inside the ice box connected with the push button switch provide the much needed illumination.

A Glimpse Into Japanese Home Life

The adoption of western civilization and the application of science to modern Japanese life have been well termed the "Occidentalization" of Japan. The appliances of western industrial invention have worked admirably in Japanese hands and excellent results have been attained in those crafts in which the nation was already skilled. It was merely the turning of old abilities into new and larger channels. While Tokyo, Yokohama, Nagoya and many other cities and towns are now illuminated by electric lights, and street cars are propelled by the electric current, still Japanese home life is about as simple and primitive as in past ages.

JAPANESE WOMEN ON WASH DAY

The Japanese women still take their tea on the floor, kneel on their kneeling cushions, use ivory chop sticks and pursue their simple pleasures. A Japanese kitchen bears little resemblance to one of our American kitchens, perhaps because we require a great deal more in our way of living. The Japanese are noted for their ability to live without much furniture or impedimenta of any kind and with a small amount of clothing.

Lafcadio Hearn, that wonderful interpreter of Japanese life, well expresses the whole matter when he says: "How intolerable may seem to the mind of the artist or poet those countless restrictions which once ruled this fairy world and shaped the soul of it, he cannot but admire and love their best results, the simplicity of old custom, the amiability of manners, the daintiness of habits, the delicate tact displayed in pleasure-giving, the strange power of presenting outwardly, under any circumstances, only the best and brightest aspects of character."

Japan is a country blessed with rainfall. The Japanese Alps constitute a region lying west of Mount Fujiyama drained by the Oigawa River, which flows south, emptying into the ocean after a lively race down a precipitous valley. With such steep slopes and such a heavy rainfall, there is abundant water power and the development of electrical industry is so fast in Japan that the home manufacturers of generators cannot keep pace with it. The importation of electrical goods is increasing at about 50 per cent per year and the United States obtains the bulk of the trade.

Of 46 electric light companies in Japan, 22 have water as a motive

A JAPANESE TEA PARTY

power, while four have water and steam.

The Hakone hydroelectric plant transmits electrical energy a distance of 36 miles to the city of Yokohama. The plant does not compare with the Katsura-Kawa in size, but it involved the trial introduction of modern steel towers and the use of apparatus and materials of domestic manufacture. The Tokyo Electric Light Company was established in

POSSIBLY THEY BELIEVE THE SIMPLE KITCHEN WITH ITS FEW UTENSILS FAR AHEAD OF FIRELESS COOKERS AND ELECTRIC RANGES

1883 and acquired a new power plant on the Katsura in 1906, but with the increasing demand for electric lighting the company has found even the present large hydroelectric plant insufficient to meet its requirements and has decided to secure a second source for hydroelectric power.

In view of the electrical developments in Japan, one cannot help but notice that women seem to have been thus far left pretty much out of it, perhaps, for all we know, by their own choice. It is possible that to their notion the old well and the portable tubs in the open air constitute an ideal laundry, while the simple kitchen with its few utensils is ahead of any electric fireless cooker of the western world.

Chemistry and Household Science

During a recent convention of the National Educational Association a professor from a college in Quebec emphasized the need of careful study of the household arts in the light of modern science. He declared that girls should have some definite correlated knowledge of the chemistry of foods, of cleaning and combustion. He said they should know something of the chemical action underlying the fermentation of fruit, the charring of sugar, the souring of milk, the electrolysis of water, the tarnishing of silver and the necessity for prompt polishing. To illustrate how unrelated some of these subjects may remain in the mind of the modern girl he told the story of a brilliant young woman who specialized in chemistry and took a year of graduate work in Germany. Then instead of teaching she finally married and the professor upon meeting her one day remarked how very useful she must now find her knowledge of chemistry in cooking and housekeeping.

"Oh," exclaimed the young matron, radiantly, "when I'm cooking I never think of chemistry!"

Too many housewives never think of chemistry, nor of the food values in the preparation of meals for the family. Happily, some of the new cook books remedy this matter by embodying in the recipes not only the how, but the why, and such books have a real scientific value.

Mission Street Light Fixtures

Electroliers for street lighting, formed of timbers and masonry, are in use in a high class residential district in Los Angeles, where they harmonize with the artistic homes. Realizing that the ordinary cast iron lamp posts would clash

MISSION STREET LIGHTING UNIT

with the surrounding architecture, the property owners had this exclusive form of lighting structure designed for their vicinity, and the result is most pleasing. The post is set on a concrete foundation and built up of dull red bricks enclosed in unpainted timbers. A simple design of woodwork surmounts the masonry and supports five bronze lamps, one at each corner and a larger one in the center. The whole design is of the popular "Mission" style.

Woman and the Electric Motor

There are many reasons why the electric motor is especially adapted to the use of women, one of the chief of which is the fact that there is no complicated machinery. About all a woman has to learn is to handle the controller and steer her car. She does not have to think of the power at all. She does not need a chauffeur, a fact which in many instances weighs heavily with the woman purchaser, for the cost of the employment of a driver may be beyond her resources.

When a woman becomes the owner of an electric car, the first thing to learn is how to steer it. It is well to select an open space for this, and the larger the better. Here she can practice turning around, backing, etc., all of which must be learned thoroughly before she attempts to drive on city streets or where traffic is congested. The ease of control is such, however, that the most congested traffic can be traversed with comparative ease, after a little experience has been gained.

The application of the brake and the movement of the controlling lever is next in order as a lesson. The controlling lever gives the different speeds, both forward and backward. On account of the interlocking devices with which every electric car is equipped there is no fear of mistake, as it is a matter of just simply progression from one to another, or reverse.

In driving her car the woman should realize that the battery has limitations and ought not to be worked down to

AS A MEANS OF AMUSEMENT, RELAXATION AND PLEASURE, THE ELECTRIC CAR IS AN ESPECIALLY FINE PRODUCT OF MODERN CIVILIZATION

the last evidence of energy, as the battery needs a certain amount of energy and a certain quantity before it will operate the motor. Though the pressure be the maximum, if it were not renewed it would not accomplish much, and so the battery must have a substantial reserve before it can be expected to do its best. It will be found by observation that the meters give accurate readings of the conditions which exist, and these will indicate what can be done and what had best not be undertaken.

The woman operator should have a practical knowledge of the construction of the motor, the wiring, etc., as this will enable her to overcome difficulties. The troubles experienced by the motorist are more a matter of the owners than the cars. If the operator has the ability to ascertain the difficulty and to remedy it at once, there will be but little to contend with. Necessity is the mother of invention, and the woman who can study out and solve the conditions which may from time to time arise is the one who will develop into the expert and successful driver.

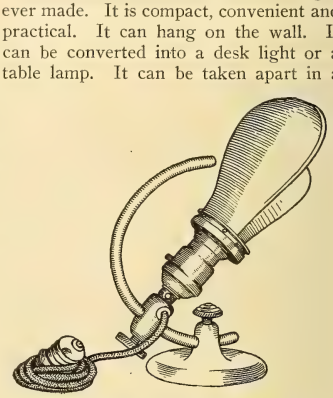
Taken purely as a means of amusement, relaxation and pleasure, the electric car is an especially fine product of modern civilization. By its use, those good gentlemen of the medical profession will find less necessity for sending patients to swell the receipts of some cure, resort or retreat. There never was, and never will be, such a remedy for the tired, overworked human body as the pure, fresh air.—Mrs. A. Sherman Hitchcock.

Mountain Breezes by Wire

What is more delightful on a hot summer's day than cool mountain breezes, gentle, invigorating breezes that fan away your worries, rest your tired body and put action into your veins? You can have the comfort of such breezes every hot day without going to the mountains. While "Old Sol" is driving people to seek relief in the hills, you can sit in your home and, by merely turning a switch, have breezes delivered to you instantly by wire.

The Port-A-Lite

The Port-A-Lite is the handiest light ever made. It is compact, convenient and practical. It can hang on the wall. It can be converted into a desk light or a table lamp. It can be taken apart in a minute and packed in a small box and carried in a grip when traveling. It is used extensively by tourists and travelers who want a light where they want it. This little lamp has ten different adjustments and can be used either in the home or the office.



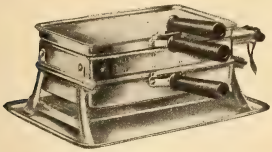
THE PORT-A-LITE

Electric Cooking Reduces Shrinkage

That in a nine pound leg of mutton as much as 1½ pounds of meat may be saved by cooking in an electric oven, as compared with cooking the same joint by coal or by gas, may be easily demonstrated upon trial. There is a shrinkage of from 25 to 35 per cent in the weight of meat cooked by coal or gas, while the same kind of animal food cooked to the same degree by electricity loses only ten to fifteen per cent of its original weight. Therefore, even if gas or coal cost nothing, it is cheaper to use the electric cooker, since there is a third less loss, compared with cooking by gas or coal.

El Grillo

Electric cooking offers the widest field for localized electric heat. Instead of a good proportion of the heat going up the chimney or into the room, the heat is concentrated in the place where it is wanted and most needed. When the heat is not needed the current can be turned



EL GRILLO ELECTRIC STOVE

off and no waste occurs. Another good point is that the heat can be obtained at a moment's notice, and the cooking apparatus is portable and can be moved from room to room as is convenient.

El Grillo is a new electric stove that will do the cooking for a small family, quickly and economically. At breakfast time, broiled bacon and fried eggs, or sausage and griddle cakes, or shirred eggs and toast, any two of them may be ready in less than five minutes from the time the electricity is turned on. At luncheon time the glowing multi-cooker provides hot dainty foods so quickly. For dinner, broiled chops and hashed brown potatoes may be prepared in a few minutes. The double boiler for rice or cereals, the tea pot or coffee pot or even the cheery corn popper can be used with efficiency on El Grillo. The device includes a deep dish, a medium dish and a griddle. All are used interchangeably above or below the coils. Each has an always cool handle.

The El Grillo dishes are all made of pressed steel with nicely rounded corners, nickeled and polished. Not only are electric utensils cleanly and convenient but they are a real adornment to the table. No dirt accumulates on such utensils on account of combustion and therefore washing up afterwards is not such a disagreeable process.

Emancipated

"The very first time I ever used an electric iron," exclaimed a mother and a home maker, "I felt emancipated! Now I can press a waist or iron a bonnet string without incurring the ire of the maid by asking her to stop her work and do it for me. I shall never forget my feeling of delight when I discovered that I could iron a waist with so little trouble and without having to descend to the laundry to do it. Electricity is a great thing for the home maker who has only one maid-of-all-work."

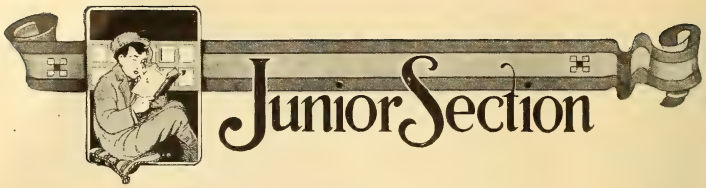
Electricity Enhances Jewels

According to the Marquis de Castellane, the French women of fashion are wearing hair of gold. Tiny luminous balls are arranged in the hair. They are so small that they are scarcely visible to the naked eye. These are lighted by a miniature electric battery placed in the corsage or bodice. A tiny button is pressed and the hair is illuminated. If a tiara of diamonds be worn the lights properly placed make a most dazzling effect. Earrings also carry one or two little luminous globes behind the jewel.

Just Plain Mothers

At a recent reception where there was a mingling of writers, art teachers and specialists, two ladies after being presented to a writer laughingly remarked: "You know we are not specialists in anything. We are just plain mothers."

A woman who has been well trained in home activities ought to be a more efficient worker in the great civic and social enterprises, for the home is the national civic unit. Into the home pour all the products of the world—food, clothing, books, furnishings and utensils. The latter differ so much from the old-fashioned pots and pans, especially the modern electric cooking utensils, which are the very newest products to pour into the modern home and are daily demonstrating their value, especially to just plain mothers.

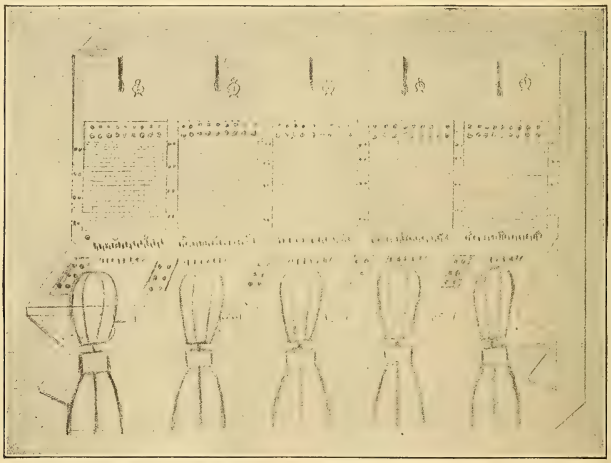


Deaf Children Visit Telephone Exchange

Eight pupils of the Chicago Training School for the Deaf, with their teacher, Mrs. A. F. Smith, recently visited the Wabash Avenue exchange of the Chicago Telephone Company. These children are not allowed to talk on their hands in the old way, nor to use pencil and paper in communicating, but are limited to the use of the face muscles and vocal organs only.

The children were taken up on the roof of the exchange, where they saw the great wireless installation on the Heisen Building across the street, and were much impressed with the idea that wireless telegrams could be sent from these masts for hundreds of miles.

When their teacher imparted any information to them, they immediately explained it over to her, as they had been trained to do, to show that they understood—a sort of "repeated message" system of instruction.



TELEPHONE SWITCHBOARD DRAWN FROM MEMORY BY DEAF AND DUMB CHILD

In the operating room they learned the difference between an A board and a B board, as well as the use of the special positions. Mrs. Smith asked a little eight-year-old if he knew what a hospital was for. He said, "To cure sick people." "What do you suppose," she continued, "this hospital switchboard is for?" "To call the doctor quick," he replied.

One boy asked to see the girl that worked the fastest, and one boy of ten asked how many calls all the girls could handle in a day.

They showed marked politeness in talking with their hosts, but in "talking" with each other they were often impatient and would resort to violent facial distortions and grimaces. Their teacher would coach them to speak more distinctly by touching their throats or lips, indicating the unruly members.

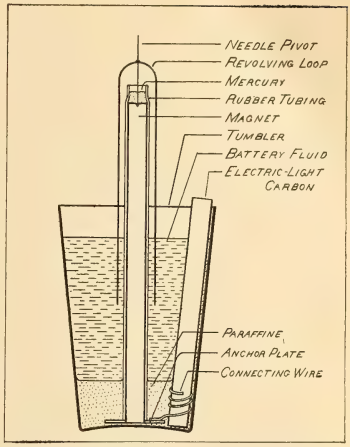
These children could understand practically all that was being said in their presence, even reading the faces of the operators and repeating what the girls said into their transmitters. The children were given colored marking plugs and were delighted with the play of colors of the switchboard lamps.

The next day after their visit they wrote polite letters in neat penmanship to Chief Operator Elizabeth V. Goggins, thanking her for her kindness, and mentioning things that had interested them. Several of them drew from memory sketches of the things they had seen and got as many details right as any normal grown person would do under similar circumstances. Among the letters was one which referred to the telephone receiver as a "listening handle."

Electro-Magnetic Rotation Experiment

In 1821 Dr. Michael Faraday discovered that a metallic conductor carrying an electric current and placed within the influence of a magnetic pole would exhibit a strong tendency to move across the lines of force of the magnetic field. An easy experimental demonstration of this historic phenomenon, interesting because it illustrates the vital principle of the modern electric motor, may be made with the simple apparatus here described.

A permanent magnet of ⅜ inch round steel eight inches long is fixed upright in the center of a tall glass tumbler by



ELECTRO-MAGNETIC ROTATION EXPERIMENT

means of paraffine melted and poured into the tumbler to a depth of about one inch. To give the magnet a firm fixture in the wax it is provided with an anchoring plate made by soldering a centrally apertured disk of thick sheet brass onto the magnet's lower end. The magnet is covered over its whole length with a piece of closely fitting rubber tubing which extends about half an inch above the magnet's top to form a small chamber for containing a small quantity of mercury.

A strip of thick sheet zinc ⅜ inch wide and ten inches long, shaped into U form, has soldered through the middle of its bend a stout sewing needle, whose point, projecting downward through the mercury, rests in a small indentation made with a center punch in the top of the magnet before tempering. The limbs of the zinc loop which hang down alongside the magnet are made to approach the latter as closely as possible without rubbing as the loop turns on its pivot.

A piece of electric light carbon placed as shown within the tumbler has its

lower end wired beneath the paraffin into electrical communication with the lower end of the magnet. Bichromate battery fluid poured into the tumbler until its upper surface is slightly above the center of the magnet, and immersing the ends of the zinc loop to a depth of about an inch, completes the apparatus.

It will be seen that the combination constitutes a galvanic cell, a part of whose closed circuit—the zinc loop—is freely movable. Under these conditions the loop sets up a rapid rotation about the magnet in a direction depending upon which pole has been placed uppermost.

Static Electric Top

The continuous action electric top here described furnishes an interesting demonstration of static electric attraction and repulsion.

The top is a disk of stiff mica 4⅝ inches in diameter mounted between two small buttons of wood or vulcanite upon a slender axis made from a piece of steel knitting needle. The pointed lower end

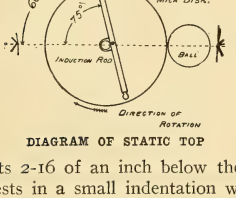
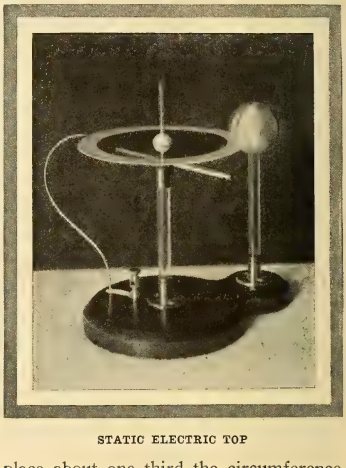


DIAGRAM OF STATIC TOP

projects 2-16 of an inch below the disk and rests in a small indentation worked with the point of a file in the upper end of the vertical glass standard made from a piece of druggist's acid rod. To give the disk a finished appearance, a broad band of red insulating varnish made by dissolving red sealing wax in alcohol is applied to the disk's circumference.

At the edge of the disk and as close to it as possible without touching is a 1½ inch polished brass or aluminum ball carried by a second support of glass. Rising from the base of the instrument at the left is a curved brass discharge wire arranged so that its pointed upper end approaches the disk's edge very closely from a horizontal direction, at a



STATIC ELECTRIC TOP

place about one third the circumference of the disk from the ball.

Beneath the disk, attached by a small brass fixture to the glass stem near its top and on the side nearest the ball, is a polished metallic induction bar with rounded ends, made of ¼ inch round brass rod. This rod is 4⅝ inches long and is so placed that its upper surface is about ⅝ of an inch below the disk. The angular position of the induction rod and wire discharge point relative to the ball is important. The most effective arrangement is that shown in the diagram, in which the wire point and induction rod make angles respectively of 60 and 75 degrees with an imaginary line drawn through the centers of disk and ball.

In operating, the insulated ball is connected to the negative pole of a static machine—that pole which gives the brush effect on its collecting combs—the positive pole being joined to the discharge wire through the binding post on the base. The disk, held in position for a

few seconds with the fingers placed lightly upon the upper end of its axis, immediately begins a swift rotation, when the finger may be removed and the top will spin at a high speed. That position of the disk at the discharge wire receives along its edge and adjacent surface positive electrification, causing repulsion from the point with simultaneous attraction from the negatively excited ball. Rotation ensues, the charged sections of the mica arriving at the ball, giving to it positive electricity and receiving negative in a hissing stream of minute sparks. These parts are impelled forward by the similarly charged ball, until within the attracting influence of the positive wire when the cycle is repeated.

The precise nature of the influence exerted by the brass rod below the disk is somewhat obscure. Through some inductive process its presence seems to effect a certain needed balancing of the acting forces; without it the top indulges in violent gyrations and soon tumbles off. —H. B. Dailey.

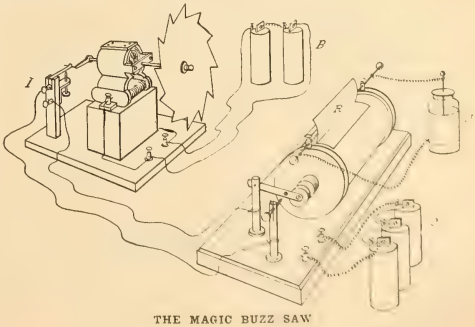
The Magic Buzz Saw

The singular spectacle of a circular saw really revolving at full speed, but having every appearance of being absolutely at rest, with all its teeth distinctly visible, is one easy of demonstration by anyone having an induction coil and a small electric motor. The figure shows the arrangement of apparatus for this experiment.

A rather coarse toothed buzz saw six or eight inches in diameter, cut out of thin sheet iron is mounted upon the spindle of a small motor, driven by the battery (B). A separate battery (C) operates the induction coil, whose regular circuit-breaker is thrown out of action by moving the contact screw permanently out of contact with the vibrator spring. Wires are attached to the interrupter posts and led to the binding screws of an independent interrupter (I), in the rear of the saw motor and actuated by it. This interrupter consists of a short piece of watch spring mounted at the top of a stiff wooden post attached to the motor base. The spring which is provided with a platinum contact bears slightly against a platinum pointed adjustable screw placed just below it.

The motor shaft, which will have to be made especially for the purpose, is prolonged, terminating in a short crank which engages the end of the spring, lifting it out of contact and breaking the primary circuit of the induction coil once for each revolution of the saw.

It is evident that with such an arrangement the occurrence of the light flashes from the secondary of the coil must exactly synchronize with the revolution of the motor, the result being that in a darkened room, owing to the instantaneous character of the perfectly timed intermittent illumination, the swiftly moving saw appears to stand perfectly still with every tooth and mark upon its surface as plainly visible as if it were actually at rest. The fine print of a scrap of newspaper pasted upon its face may be easily read with the saw running at 2,000 revolutions per minute.



THE MAGIC BUZZ SAW

To prove to the spectator that it is really in motion and not at rest as it seems, small raw potatoes may be readily sliced with it; and it is indeed a novel sight to see such objects drop in two when held apparently *between* the seemingly stationary teeth.

A small Leyden jar (J), with its inner and outer coats connected as shown with the secondary terminals of the coil, adds greatly to the brightness of the illumination, which is still further assisted by the white paper reflector (R). The front face of the saw may with advantage be painted white.

In working up this experiment the light from a Geissler tube was first tried, but was found inferior to that of the naked spark, owing to the phosphorescence of the glass, which, lasting a brief time after the passage of each discharge, interferes materially with the clearness of the effect by impairing the instantaneous nature of the light flashes.

An Electric Weather Vane

By KARL KOCH

Procure a piece of board ½ inch thick and about six inches square or, if to be finished round, 5½ inches in diameter. Center it and draw a circle 2¼ inches in diameter. Divide this circle into eight parts. These are for the different poles and the magnets will border this circle.

The magnet coils are made of ⅜ inch stock, soft Norway pine, one inch long. Eight of these are necessary. In one end of each core drill a hole ⅜ inch deep with a No. 28 drill and thread it with an 8-32 tap.

The spools are made as follows: Procure a sheet of 1/16 inch fiber or tough cardboard and cut out sixteen circles ⅞ inch in diameter. Drill a ⅜ inch hole in the center of these and glue one to each end of the core with iron glue. When dry wind two turns of paraffine paper around the core and wind the spool full of No. 22 or 23 B. and S. gauge double cotton covered wire; be sure you wind all in the same direction relatively to the holes in the cores.

A small right angle is made of 1/16 inch brass for each core to fasten the spool to the base, of dimension, as in Fig. 1. In the side, ¾ inch long, is drilled a hole with a No. 17 drill, 5/16 inch from the end; this is to fasten the angle to the core with an 8-32 screw. The other half inch of the angle passes under the spool and a hole is drilled in it for any convenient wood screw. A small groove is scooped in the wood for the angle to rest in.

The pivot for the dial hand is made as in Fig. 2. A brass rod is turned down to the dimension shown and the small end threaded for a 2-64 thread within 1/32 inch of the shoulder; the rest of the rod is cut with a 10-24 thread.

Drill a hole with a No. 6 drill in the center of the base, slide the pivot through here with a 10-24 adjusting nut on each side of the base; this is for an easy method to centralize the dial hand; otherwise it will have a tendency to draw upward or downward and thereby increase friction.

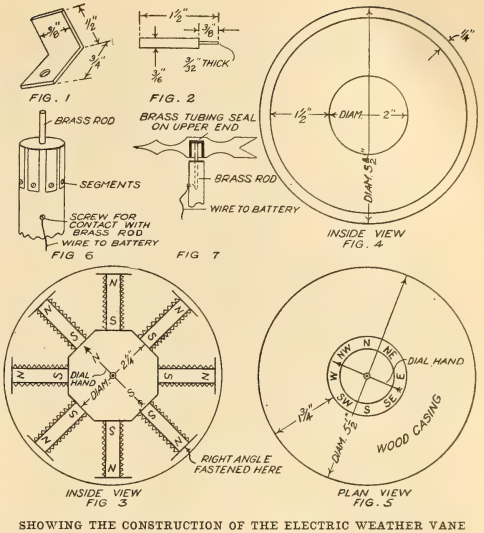
The dial hand may be made out of an old saw blade 1/32 inch thick, although thinner would be better. It should be 1/16 inch wide (except where it is to be pivoted, which portion should be ⅛ inch wide) and two inches long, pivoted to a dead center, hardened and magnetized. It makes no difference what the polarity of the pointer is, as will be shown.

The dial hand or pointer is drilled as close as possible on a dead center with a No. 42 drill, so that it will rest on the shoulder of the pivot rod. Two 2-64 nuts will serve to lock the position of pointer. The instrument now assumes

the form seen in Fig. 3. The dial hand swings clear of the magnets by an eighth of an inch.

A wood covering for the instrument is seen in Fig. 4. A circular block of wood 5½ inches in diameter and 1¼ inches thick is bored one inch deep to a diameter of five inches. A hole two inches in diameter is continued on clear through the center, to allow a view of the dial and hand. The instrument finished is seen in Fig. 5.

The vane may be made of wood and painted in the desired color. The rear end should present the greatest surface to the wind.



SHOWING THE CONSTRUCTION OF THE ELECTRIC WEATHER VANE

Fig. 6 shows the segments of the commutator fashioned out of 1/16 inch brass and fastened to a piece of broom handle. The brass rod that protrudes from the handle is 1/16 inch longer than the tubing that fits in the vane so that the vane can ride around on it and at the same time make contact with the tube as shown in Fig. 7. The upper end of the tube is closed by soldering a piece of circular brass on it.

A brush is fashioned out of 1/64 inch bronze and fastened to the side of the vane with two screws that make contact with the tubing and incidentally hold the tubing in place. The brush should make good contact with the segments.

The beginning wires of all the magnets are connected together and run to one pole of the battery and the other terminal wires of the magnets are run respectively to each segment. If the vane points, say, in a southern direction and the brush is on the left-hand side of the vane, the segment due east will have to be connected to the magnet that will cause the dial hand to register south. If, instead of the hand pointing south, it points north, change the direction of the current; this will change the polarity of the magnets. The brass rod is connected to the other pole of the battery.

A dial may be made to suit one's fancy. Three gravity cells will keep it "on the job" continually.

How Uncle Sam Trains His Sailors in Wireless

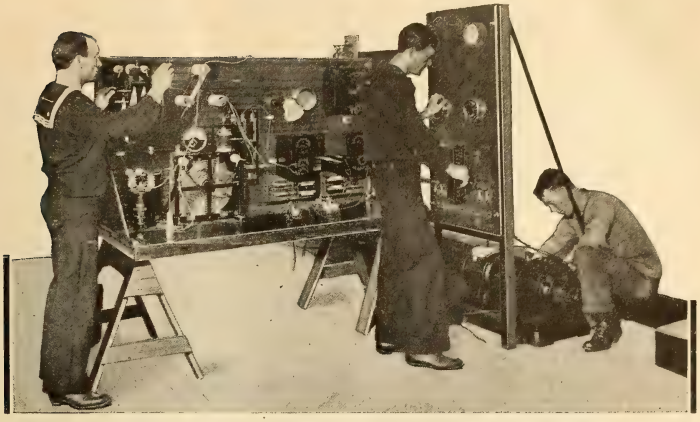
How to provide the vast number of ships in the Navy with men expert in the construction and operation of nautical wireless apparatus was one of the many perplexing problems which confronted Uncle Sam.

When wireless was invented the powers of the world at once realized its wonderful usefulness in their navies. The United States was among the first to adopt it and all of the vessels were ordered equipped. As a result there arose a very great and widespread need for wireless men. So Uncle Sam set about establishing a school of instruction in wireless at the Brooklyn Navy Yard. This is the first institution of its kind in the United States. There are now on an average 160 men in the class, in charge of Commander George Cooper, while under Commander Cooper is a corps of ten instructors.

The students are enlisted men, who have had experience in the dynamo room on board of a battleship and civilian electricians who have enlisted in the Navy for the purpose of taking the course and entering the naval electrical field. In the wireless classroom are three long tables running almost the entire length of the big hall. The students sit at their places along these tables with head receivers on and take down the messages sent by an operator at the master key. At the foremost table the messages come in rapidly and at the next table slower, while at the rear table, which is for the beginners, there is a pause after each letter of the code, to give the student time to recognize it.

The men graduate from the rear table forward as they acquire speed in receiving. The messages received at these tables do not come through the air and

INSTRUCTION IN WIRELESS OPERATING AT THE BROOKLYN NAVY YARD



U. S. NAVAL STUDENTS STUDYING WIRELESS APPARATUS THROUGH ACTUAL OPERATION

over an aerial, but instead are transmitted by wires from the master key to the head receivers and in every respect, particularly in the sound, are a perfect imitation of a real wireless message. In case a student shows himself particularly gifted and easily receives the messages at the rate at which they come in at the first table, he is put in a booth by himself and receives real wireless messages coming in on the Navy Yard aerial.

The course covers a period of 22 weeks and embraces complete courses in wireless, theory, lighting and interior communication of a battleship, dynamos and motors, engine construction and mechanics. The students are classed as landsmen-electricians and are quartered on the receiving ship Hancock, which was the old Arizona, one of the first trans-Atlantic liners, purchased by the Army for a transport during the Spanish-American War. It was later turned over to the Navy as a receiving ship.

Radio-Telegraphy in Time Regulation

There has for some time been considered the possibility of employing signals sent by wireless telegraphy to correct the time of chronometers and clocks. Not so long ago a practical test was made between two great transatlantic steam-

U. S. NAVY ELECTRICAL CLASS OF 1912—BROOKLYN NAVY YARD

ships in mid-ocean, which thus exchanged their chronometer times. One was found a few seconds in error.

Claude and Ferrie have reported to the Paris Academy of Sciences the results of their experiments with wireless time signals between Paris and Montsouris, showing that the method is capable of furnishing comparisons within a limit of error of less than one one-hundredth of a second.

Photograph of a Rotary Spark Discharger

The photograph here shown was made while the sending spark was discharging at the rotary spark discharger used in the five k. w. Marconi wireless station on

FROM A PHOTOGRAPH OF A ROTARY SPARK

the Wanamaker Store, Philadelphia, Pa. The discharged disk was running at the rate of 1,800 revolutions per minute and the diameter of the revolving stud circle being eighteen inches, the studs were traveling at the rate of 9,483 feet per minute, or 110 miles per hour. A time exposure was made and yet the revolving studs and their shadows are plainly shown in the photograph as though they were standing still. The reason for this is that the spark took place only at the instant when the moving stud passed the stationary studs, and the operating room being dark, the disk and revolving studs were illuminated only when in exactly the same position each time a spark took place. This effect may also be observed without the use of a camera by darkening any wireless room where a rotary discharger is used. At some stations the studs, instead of appearing to stand still, will jump backward and forward. The cause of this is that the studs are not evenly spaced and therefore not always in the same position when the spark takes place, the effect being somewhat similar to a moving picture when the film runs off the roller, causing the shutter to cut off the light at the wrong time and the picture to jump up and down.

Wireless to Stop Trains

The new wireless system of controlling trains was tested recently at Stratford-on-Avon, in England. As a passenger train, almost empty, was passing through the Midland Junction Railway Station, Professor Silvanus P. Thompson, the well-known electrical scientist, standing on the platform and acting as an amateur signalman, pressed an electric button and brought the train to a standstill in well under 300 yards.

An electric wire lay embedded in the ground, the brake-van of the train was fitted with a receiving apparatus, and the button which Professor Thompson pressed sent a warning along the embedded wire which caught up the train and was attracted through the intervening air waves and caught by the receiver in the brake-van.

The immediate result was that the air brake was automatically acted upon.

In the words of the discoverer of this new system of train controlling, Mr. H. von Kramer, a young Birmingham scientist, "the train stopped and a hooter attached to the van sounded."

Popularly, the system is known as the Ralophone, and besides stopping a train by pressing a button, the 200 or so railway experts and scientists who saw the tests say that all sorts of other wonders can be accomplished. For instance, in experiments that followed, a fast train following a slow one on the same line was pulled up automatically by wireless.

Questions and Answers in Wireless

By A. B. COLE

POTENTIOMETERS.

67.—*Describe the construction of a potentiometer.*

A potentiometer consists of a resistance rod or coil, across the ends of which the battery is connected. A sliding contact touching the resistance element is provided so that more or less resistance may be placed in circuit at will.

68.—*Describe the operation of a potentiometer.*

Referring to Fig. 22, (R) is the resistance rod generally used, (B) the

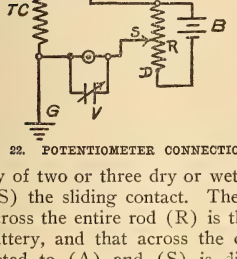


FIG. 22. POTENTIOMETER CONNECTIONS

battery of two or three dry or wet cells, and (S) the sliding contact. The voltage across the entire rod (R) is that of the battery, and that across the circuit connected to (A) and (S) is directly proportional to the distance (A-S). If, therefore, the voltage of the battery is three, and (S) is at the center of the rod, the voltage across (A-S) will be 1½. If distance (A-S) is one-third that of (D-A) the voltage across (A-S) will be one volt. This rule applies only if the current flowing through the detector circuit connected to (S) and (A) is small compared to the current flowing through rod (R).

From the above it will be seen that the voltage across the detector circuit can be closely regulated. For the high resistance element a carbon rod is sometimes employed, but the diameter must be so small that the rod is liable to break. Another type of potentiometer uses a hard rubber rod wound with enameled German silver wire as a resistance element.

69.—*What should be the resistance of the resistance rod?*

A resistance of 200 ohms is quite sufficient for ordinary use, for with such a resistance the voltage across the detector can be regulated to a small fraction of a volt.

70.—*What is the difference between an inductive and a non-inductive potentiometer?*

In an inductive potentiometer the resistance rod has inductance, so that any high frequency currents which would otherwise pass through it will be choked back. In the non-inductive potentiometers there is no inductance in the resistance element. The type employing the German silver coil on the hard rubber rod is an inductive potentiometer, and the type using a carbon resistance rod is non-inductive.

71.—*It is claimed by some that the non-inductive type of potentiometer gives better results than the inductive type. Is this so?*

A non-inductive potentiometer will respond somewhat more readily to sudden changes in the resistance of the detector, whereas there is a certain lag to the response of the inductive type. On the other hand, consideration of Fig. 22 will show that the potentiometer offers a path in shunt with the detector, and unless some precaution is taken part of the energy which should affect the detector will take the path through the potentiometer, thereby reducing the receiving range of the station. If an inductive potentiometer is used, the convolutions of wire retard the passage of

high frequency currents through them, and consequently nearly all will pass through the detector, doing useful work.

RECEIVERS

72.—Describe the most commonly used types of permanent magnets of a telephone receiver.

In wireless telegraphy the watch case types of receivers are most generally employed for the sake of lightness and convenience. The ordinary forms of permanent magnets are illustrated in Figs. 23 and 24. In Fig. 23 (P) represents the permanent magnet, which is composed of several laminations placed one above the other, and (N) and (S) are the poles produced by the magnets. The bobbins of wire are wound on poles (N) and (S).

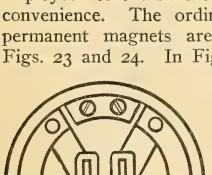


FIG. 23. TELEPHONE MAGNETS

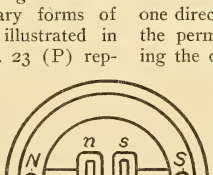


FIG. 24. CONSEQUENT POLE TYPE RECEIVER

Fig. 24 represents a permanent magnet, composed of laminations, of the "consequent pole" type, and this type is composed of an unbroken ring of steel, so magnetized that the poles are formed at (N) and (S), and in consequence (n) and (s), within the bobbins, are north and south poles, respectively.

The "single pole" receiver consists of a core of soft iron wound with wire, and set in a steel shell, the center of the iron core being placed directly beneath the center of the diaphragm. It will be understood, therefore, that this type of receiver is really a double pole instrument, for the iron core is one pole, and the part of the steel shell upon which the diaphragm rests is the other pole.

73.—Describe the action of a telephone receiver.

From the above discussion it will be seen that the bobbins wound with wire are placed around the effective poles of the permanent magnets. These bobbins are so wound that when one is a north pole the other is a south pole while the current is passing through them in one direction. When the direction of flow of the current is reversed, however, the polarity of the bobbins will be reversed. Therefore, while current is flowing in one direction the bobbins will strengthen the permanent magnets, thereby drawing the diaphragm down and producing a sound, and when the direction of flow is reversed the bobbins will weaken the pull of the permanent magnets on the diaphragm, and this will allow it to assume a more nearly flat position than it had when there was no current flowing and the permanent magnets drew it down a short distance. As soon as the flow of current ceases, the diaphragm is again drawn a short distance toward the permanent magnets.

It will, therefore, be understood that the effect of the permanent magnets is to increase the sensitiveness of the receiver, for with their aid the bobbins exert a greater influence while the current flows in one direction, and a less attractive influence when it flows in the opposite direction, and consequently a louder sound is produced when the same current flows through the bobbins.

For these reasons it is important that wireless receivers have powerful permanent or "field" magnets.

74.—How thick should the diaphragm of a wireless receiver be?

The proper thickness of the diaphragm of a receiver depends on its diameter, the distance between it and the field magnets and upon the strength of these magnets. If the diaphragm is made too thin, the field magnets will draw it down upon them, and if too thick they will not be able to cause sufficient movement to produce a sensi-

tive receiver. Most manufacturers of sensitive receivers have worked out carefully the proper thickness for their receivers, and we cannot recommend to the experimenter the substituting of a diaphragm of different thickness or an attempt to grind down the case of the receiver, for having considerably less experience than the maker of the receiver, the results will be very doubtful.

75.—*What effect has the winding on the bobbins in regard to the sensitive qualities of the receiver?*

Since the movement of the diaphragm depends largely on the combined effect of the bobbins and the field magnets, this winding is very important. The strength of the bobbins is directly dependent on the number of ampere turns of wire, and since the number of amperes is small, being only a fraction of an ampere, the number of turns or convolutions of wire must be large.

The general method of rating wireless receivers is by the resistance, because this is the simplest way to rate them. It must not be decided, however, that two receivers of the same resistance are equally sensitive, for very few manufacturers make identical receivers.

In making low priced receivers some makers have wound the bobbins with German silver wire and a high resistance was easily obtained in this way. Since German silver wire has a much higher resistance than copper wire, the number of turns of wire used by this method was correspondingly smaller, and the results obtained with such receivers were not satisfactory.

That Condenser Formula

On page 285 of the July issue we gave a formula for ascertaining the capacity of condensers. In the printing of the formula a grievous error was made. Instead of $D \times 10 \times 10$ for the denominator, as stated, it should have been $D \times 10^{10}$, which of course makes a vast difference in the result. In using the formula, when C, the capacity, is found it means microfarads.

New Wireless Call-Letters

The recent changes in the wireless call-letters of American merchant vessels have resulted in some confusion to amateurs, many not understanding the reason for this action.

The United States has joined the international wireless agreement, and, as a result of this, the Bureau of Navigation has been systematizing the call-letters of American ships, subject, of course, to the approval of the international bureau at Berne, Switzerland.

Under the new arrangement each call will consist of three letters. The call-letters of American ships on the Pacific coast will begin with W, while Atlantic coast vessels have been assigned the series beginning with K.

As far as practicable the same second letter has been assigned to vessels of the same line, while the third letter of each call will be distinctive.

American naval vessels will continue to use the series beginning with N.

Directory of Wireless Clubs

This directory of amateur wireless clubs and associations will be published each month. When a new club is formed the names of the officers, also the street address of the secretary, should be forwarded to us at once. Any changes that should be made in the directory, when designated by an official of a club, will be made in the next issue after receipt of such advice.

Aerogram Club.—J. Stedman, President; A. Hayward Carr, Chairman Board of Directors; Albert S. Hayward, Treasurer; Donald P. Thurston, Secretary; Walter B. Clarke, 17 May St., Newport, R. I., Corresponding Secretary.

Aerograph Club of Richmond, Ind.—H. J. Trueblood, President; Richard Gatzek, Vice President; James Pardieck, 320 South 8th St., Richmond, Ind., Secretary.

Aero Wireless Club.—A. Garland, President; W. Ladley, Vice President; D. Beard, Napa, Calif., Secretary and Treasurer.

Allegheny County (Pa.) Wireless Association.—Arthur O. Davis, President; Theodore D. Richards, Vice President; James Seaman, Leetsdale, Pa., Secretary and Treasurer.

Alpha Wireless Association.—L. L. Martin, President; F. A. Schaeffer, Vice President; G. F. Girton, Box 57, Valparaiso, Ind., Secretary and Treasurer.

Amateur Wireless Association of Schenectady, N. Y.—D. F. Crawford, President; L. Beebe, Vice President; C. Wright, Treasurer; L. S. Uphoff, 122 Ave. "B," Schenectady, N. Y., Secretary.

Amateur Wireless Club of Geneva (N. Y.).—H. B. Graves, Jr., President; C. Hartman, Vice President; L. Reid, Treasurer; Benj. Merry, 148 William St., Geneva, N. Y., Secretary.

Arkansas Wireless Association.—G. A. Rauch, President; Edward Vaughn, 2622 State St., Little Rock Ark., Secretary and Treasurer.

Berkshire Wireless Club.—Warren A. Ford, President; William Yarkee, Vice President; Charles Hodecker, Treasurer; Jas. H. Ferguson, 18 Dean St., Adams, Mass., Secretary.

Canadian Central Wireless Club.—Alexander Polson, President; Stuart Scorer, Vice President; Benj. Lazarus, P. O. Box 1115, Winnipeg, Manitoba, Can., Secretary and Treasurer.

Cardinal Wireless Club.—K. Walthers, President; F. Dannenfelser, Vice President; Miss A. Peterson, South Division High School, Milwaukee, Wis., Secretary.

Chester Hill Wireless Club.—Waller Morgan, President; Richard D. Zucker, 46 Clinton Place, Mt. Vernon, N. Y., Secretary and Treasurer.

Chicago Wireless Association.—John Walters, Jr., President; E. J. Stien, Vice President; C. Stone, Treasurer; F. D. Northland, Secretary; R. P. Bradley, 4418 South Wabash Ave., Chicago, Ill., Corresponding Secretary.

Custer Wireless Club.—Franklin Webber, President; Fred Cross, Vice President; Oakley Ashton, Treasurer; Walter Maynes, 438 Custer Ave., Los Angeles, Cal., Secretary.

De Kalb Radio-Transmission Association.—Bruce Lundberg, President; Walter Bergendorf, Vice-President; De Estin Snow, Treasurer; Bayard Clark, 205 Augusta Ave., De Kalb, Ill., Secretary.

Fargo Wireless Association.—Kenneth Hance, President; John Bathrick, Vice President; Earl C. Reineke, 518 9th St., Fargo, N. D., Secretary.

Forest Park School Wireless Club—W. S. Robinson, Jr., President; William Crawford, R. F. D. No. 1, Springfield, Mass., Secretary.

Frontier Wireless Club.—Chas. B. Coxhead, President; John D. Camp, Vice President; Franklin J. Kidd, Jr., Treasurer; Herbert M. Graves, 458 Potomac Ave., Buffalo, N. Y., Secretary.

Geneva Wireless Club.—Charles B. Hartman, President; Charles Smith, Vice-President; Benjamin Merry, Treasurer; Henry B. Graves, Jr., 448 Castle St., Geneva, N. Y., Secretary.

Gramercy Wireless Club.—James Platt, President; John Gebhard, Vice President; John Diehl, Treasurer; John Jordan, 219 East 23d St., New York, N. Y., Secretary.

Greenfield Wireless Association.—Edward M. Wolfe, President and Corresponding Secretary, 4125 Haldane St., Pittsburgh, Pa.

Hannibal (Mo.) Amateur Wireless Club.—Charles A. Cruickshank, President; J. C. Rowland, Vice President; William Youse, Treasurer; G. G. Owens, 1306 Hill St., Hannibal, Mo., Secretary.

Haverhill (Mass.) Wireless Association—Riedel G. Sprague, President; Charles Farrington, Vice President; Leon R. Westbrook, Haverhill, Mass., Secretary and Treasurer.

Hobart Wireless Association.—Asa Bullock, President; Charles Clifford, Hobart, Ind., Secretary.

Independence Wireless Association.—Boyce Miller, President; Ralph Elliott, Secretary; Joseph Mahan, 214 South Sixth St., Independence, Kan., Vice President.

Independent Wireless Transmission Co.—Starr W. Stanyan, 76 Boston Ave., West Medford, Mass., Secretary.

Jonesville Wireless Association.—Frederic Wetmore, President; Webb Virmylia, Vice President; Richard Hawkins, Treasurer; Merritt Green, Lock Box 82, Jonesville, Mich., Secretary.

Lake View Wireless Club.—E. M. Fickett, President; R. Ludwig, Treasurer; R. F. Becker, 1439 Winona Ave., Chicago, Ill., Secretary.

Long Beach Radio Research Club.—Bernard Williams, 555 E. Seaside Bvd., Long Beach, Calif., Secretary.

Manchester, (N. H.) Radio Club.—Homer B. Lincoln, President; Clarence Campbell, Vice President; Elmer Cutts, Treasurer; Earle Freeman, 759 Pine St., Manchester, N. H., Secretary.

New Haven Wireless Association.—Roy E. Wilmot, President; Arthur P. Seeley, Vice President; Russell O'Connor, 27 Vernon St., New Haven, Conn., Secretary and Treasurer.

Northwestern Wireless Association of Chicago—Rolf Rolfson, President; H. Kunde, Treasurer; Edw. G. Egloff, 2729 Noble Ave., Chicago, Ill., Recording Secretary.

Oakland Wireless Club.—H. Montag, President; W. L. Walker, Treasurer; W. R. Sibbert, 916 Chester St., Oakland, Calif., Secretary.

Oklahoma State Wireless Association.—T. E. Reid, President; G. O. Sutton, Vice-President; Ralph Jones, Box 1448, Muskogee, Okla., Secretary and Treasurer.

Oregon State Wireless Association.—Charles Austin, President; Joyce Kelly, Recording Secretary; Edward Murray, Sergeant-at-Arms; Clarence Bischoff, Lents, Ore., Treasurer and Corresponding Secretary.

Peterboro Wireless Club.—G. B. Powell, President; C. V. Miller, Vice President; E. W. Oke, 263 Engleburn Ave., Peterboro, Ontario, Can., Secretary and Treasurer.

Plaza Wireless Club.—Paul Elliott, President; Myron Hanover, 156 E. 66th St., New York, N. Y., Secretary and Treasurer.

Rockland County (N. Y.) Wireless Association.—W. F. Crosby, President; Tracey Sherman, Vice President; Marquis Bryant, Secretary; Erskine Van Houten, 24 De Pew Ave., Nyack, N. Y., Corresponding Secretary.

Roslindale (Mass.) Wireless Association.—O. Gilus, President; E. T. McKay, Treasurer; Fred C. Fruth, 962 South St., Roslindale, Mass., Secretary.

Sacramento Wireless Signal Club.—E. Rackliff, President; J. Murray, Vice President; G. Banvard, Treasurer; W. E. Totten, 1524 "M" St., Sacramento, Calif., Secretary.

Santa Cruz Wireless Association.—Orville Johnson, President; Harold E. Sentor, 184 Walnut Ave., Santa Cruz, Calif., Secretary and Treasurer.

Southeastern Indiana Wireless Association—R. F. Vanter, President; D. C. Cox, Vice President and Treasurer; H. Hitz, Fairmont, Madison, Ind., Corresponding Secretary.

Southern Wireless Association.—B. Oppenheim, President; P. Gernsbacher, 1435 Henry Clay Ave., New Orleans, La., Secretary and Treasurer.

Springfield (Mass.) Wireless Association.—A. C. Gravel, President; C. K. Seely, Vice President and Treasurer; D. W. Martenson, Secretary; Club Rooms, 323 King St., Springfield, Mass.

Spring Hill Amateur Wireless Association.—R. D. Thiery, President; H. P. Hood, 2nd, 2 Benton Road, Somerville, Mass., Secretary and Treasurer.

St. Paul Wireless Club.—Thos. Taylor, President; L. R. Moore, Vice President; E. C. Estes, Treasurer; R. H. Milton, 217 Dayton Ave., St. Paul, Minn., Secretary.

Tri-State Wireless Association.—C. B. DeLaHunt, President; O. F. Lyons, Vice President; T. J. M. Daly, Treasurer; C. J. Cowan, Memphis, Tenn., Secretary.

Waterbury Wireless Association.—Weston Jenks, President; Alfred Upham, Treasurer; H. M. Rogers, Jr., 26 Linden St., Waterbury, Conn., Secretary.

Wireless Association of British Columbia.—Clifford C. Watson, President; J. Arnott, Vice President; E. Kelly, Treasurer; H. J. Bothel, 300 Fourteenth Ave. E., Vancouver, B. C., Corresponding Secretary.

Wireless Association of Canada.—W. Fowler, President; E. G. Lunn, Vice President; W. C. Schaur, Secretary and Treasurer.

Wireless Association of Montana.—Roy Tysel, President; Elliot Gillie, Vice President; Harold Satter, 309 South Ohio St., Butte, Mont., Secretary.

Wireless Club of Baltimore.—Harry Richards, President; William Pules, Vice President; Curtis Garret, Treasurer; Winters Jones, 728 North Monroe St. Baltimore, Md., Secretary.

Wireless Club of the Shortridge High School.—Robert C. Schimmel, 2220 N. Penn St., Indianapolis, Ind., President; George R. Popp, Vice President; Bayard Brill, Treasurer; [illegible] Hamilton, Secretary.

For Practical Electrical Workers

Motor Holster

A holster for carrying a small motor upon the back is the subject of a patent issued to H. E. Hourcher, Augusta, Ga.

MOTOR HOLSTER

The device is designed for the use of workmen who use motor driven tools in building or other construction work.

To Prevent a Transmitter From Packing

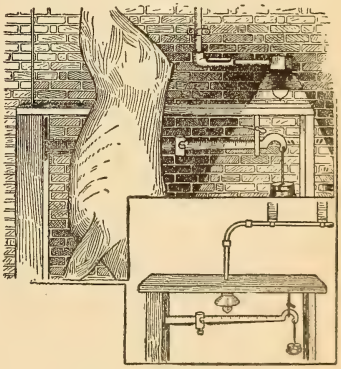
A great many of the older style telephone transmitters still on the market and in use about the country become packed on account of the accumulation of moisture in the case and cup.

A very efficient method of preventing this is to put a pinch of air slacked lime in the transmitter with the granulated carbon. This absorbs the moisture and does not impair the efficiency of the transmitter.—T. Dodd.

Suggestions in Scale Lighting

Two forms of installation for illuminating stationary scales are here shown.

One illustration shows a light used on track scales in packing plants. As the dressed beef in halves is run upon that portion of the track over the scales the



METHODS OF LIGHTING SCALE BEAMS

weight is taken. The light is installed so it may be turned close to the wall. A condulet forms the elbow upon which the light swings.

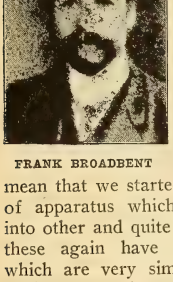
For the second installation, conduit, a sign receptacle, several pipe straps and some double braid duplex wire are needed. The pipe is run through the woodwork above the scale beam, making a stationary light in the right place.

Electric Wiring

English and American Practice Compared

By FRANK BROADBENT, M. I. E. E.

In preparing this article for POPULAR ELECTRICITY MAGAZINE, *Mr. Broadbent has endeavored to present without technicalities and by pictures some of the differences between English and American electrical apparatus and practice. Mr. Broadbent has been in electrical work in England for twenty-six years, is the author of "Chats on Electricity." He is also Examiner to the City and Guilds of London Institute in Electric Lighting and Wireman's Work, Consulting Engineer to the Illustrated London News and Sketch, etc.—Editorial Note.*



FRANK BROADBENT

Those who have closely followed the development of installation practice in England since the early eighties must have noticed what, for want of a more appropriate term, I might call a process of circular evolution. By this I mean that we started with certain types of apparatus which gradually evolved into other and quite different types, and these again have evolved into types which are very similar in principle to those with which we started.

Take for example the switch. The first switches used both for switchboards and for small circuits were of the knife-blade type, somewhat after the style of that shown in Fig. 1. This was not a very suitable form for ordinary use in a house, as it was difficult to enclose it neatly. Placed on its side, however, a single pole knife switch can be enclosed, the handle passing through a slot in the cover. This type formed a link between the true knife pattern and the rotary pattern. The latter did not quite correspond to what in America is known as a "snap" switch, as the handle was turned half a turn forward to switch the current on, and was turned backwards to switch it off. The American "snap" switch is always turned in one direction. For many years this semi-rotary type of switch was used almost exclusively for both small and large currents, but we have now reverted to an improved form of quick break knife switch—known as the "tumbler" switch. For small currents such as lighting circuits the tumbler switch is almost the only type of switch used in England.

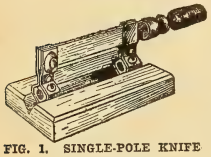


FIG. 1. SINGLE-POLE KNIFE BLADE SWITCH

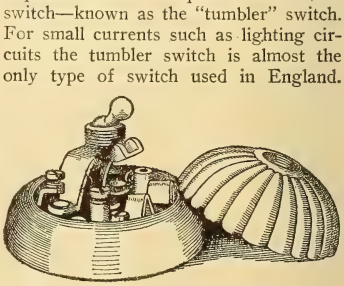


FIG. 2. "TUMBLER" SWITCH

This, as is seen from Fig. 2, is a modification of the knife switch. For switchboard work the type of switch now used bears a much closer resemblance to the original knife switch, Fig. 3. For large isolated switches, such as are used to control main circuits or motors, a similar type of switch is used, generally enclosed in a cast iron box with the operating handle outside as in Fig. 4.

For factory and workshop use enclosed

switches are preferred, and on circuits carrying pressures of 250 volts and over they are practically compulsory in order to comply with the requirements of the English Home Office. There is very little work done in factories and workshops at pressures below 200 volts. The usual pressures are 220 for lighting and 440 to 500 for motors. Hence there is very little demand for an open switch of the type shown in Fig. 5. Such a switch as is here shown would not be passed by the English Home Office inspectors on 250-volt circuits (direct current) or 125 volts (alternating) because it is possible for a man to receive a shock in the ordinary handling of the switch. Serious and, I believe, fatal accidents have occurred with switches of this kind by reason of the operator's hand coming in contact with the live fixing screws or nuts on the insulating bar when grasping the switch handle. When a switch of this type is permitted it is important to connect it up in such a way that the knives are "dead" when the switch is off, that is to say, the "live" end of the circuit must not be connected to the knife or pivot but to the isolated contacts at the top of the switch. I have known considerable trouble to result from a neglect of this precaution.

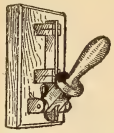


FIG. 3. KNIFE SWITCH

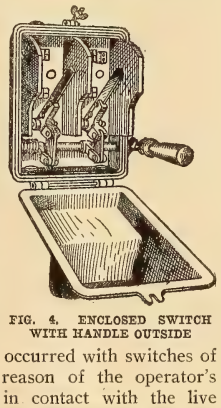


FIG. 4. ENCLOSED SWITCH WITH HANDLE OUTSIDE

Another very important accessory in electric wiring work is the safety fuse. When a considerable resistance is interposed in any portion of the electric circuit, the heat produced therein is practically proportional to the resistance interposed. It is this principle which is made use of in electric lamps, radiators, cookers and the like. If we use a substance which has a very high resistance for a small mass of material, such for instance as the filament of an incandescent lamp, we produce a white heat which is made use of for illumination. The principle of electric heating is also made use of for the protection of electric circuits by means of what in England is called the "safety fuse." This consists generally of a short piece of fusible metal, having a very small section as compared with the section of the conductor which it is intended to protect. In its simplest and oldest form the safety fuse consists of a short length of lead and tin wire for attaching to terminals as shown in Fig. 6 (a). This is generally called an open type fuse link, and when this is connected in a circuit the link will get hot and melt, thus cutting off the current if the latter should exceed a certain predetermined value. The current at which any wire will melt can be accurately calculated, and the calculations have been carefully verified by experiment. We have here what may appear

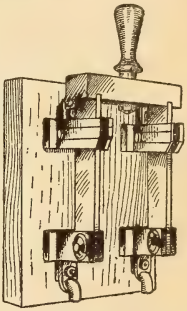


FIG. 5. OPEN, DOUBLE-POLE KNIFE SWITCH.

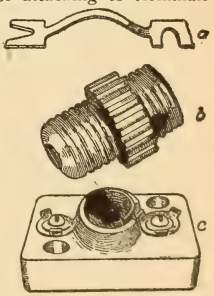


FIG. 6. FUSES AND PLUG BASE

to be a paradox, namely, that the heating property of the electric current is made use of to protect electric cables from overheating.

Fuses, like switches, have passed through various stages of evolution and there is just the possibility that we in England shall return to the original American screw socket pattern. The open type fuse link shown in Fig. 6 (a), while it is quite suitable to protect low voltage circuits, is not so suitable for high pressures and for large currents, as the spark or arc formed when the fuse melts may in itself prove a source of danger. Another disadvantage of this type of fuse link is that there is nothing to prevent a person replacing it with a larger fuse or with a piece of hard metal, such as iron or copper wire, which would not melt in the event of a dangerous current passing. It is not an uncommon thing for hairpins, or any odd piece of wire that may be available, to be used in place of fuses of this kind, and when this is done the function of the fuse is entirely destroyed.

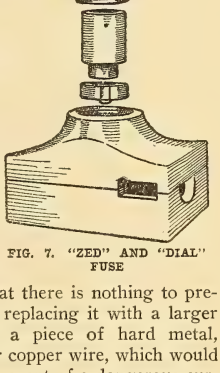


FIG. 7. "ZED" AND "DIAL" FUSE

In America the type of fuse called the Edison screw pattern has been used for many years, and years ago was used in England also. In this case the fuse link is enclosed in a screwed plug, as shown in Fig. 6 (b), this plug being adapted to screw into a base, Fig. 6 (c). When screwed home the current can pass from the contact at the point of the screw, through the enclosed fuse, and out through the threaded tube which forms the other contact. The plugs are standardized to carry certain currents, and cannot be so easily tampered with as the open type fuse link. This type of fuse has never been very popular in England, and up to quite recently was only used on installations containing American machinery, such for instance as some of the tube railways. Latterly, however, improved designs have been brought out known as the "Zed" and "Dial" fuses, Fig. 7, in which the fusible link is contained in a sort of cartridge which can be easily replaced by a nontechnical person.

When a very excessive current passes, such as is caused by what we electricians call a "short circuit," a fuse may explode with a report like a pistol. This kind of thing is more likely to occur on motor circuits than on lamp circuits, and to prevent it various devices are adopted all based more or less on the principle of smothering the spark or arc which occurs when the fuse suddenly melts and breaks the circuit. There is a sort of electrical inertia, particularly in circuits supplying motors, which tends to make the current flash over across the contacts when the fuse melts, and it is to prevent this flashing over that the smothering or damping devices have been adopted. One of the commonest of these devices is to enclose the fuse link in a fiber tube containing very fine sand or powder. The ends of the tube are capped with metal terminals to which the fuse wire is connected and

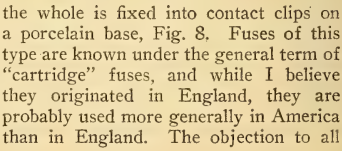


FIG. 8. CARTRIDGE FUSE

the whole is fixed into contact clips on a porcelain base, Fig. 8. Fuses of this type are known under the general term of "cartridge" fuses, and while I believe they originated in England, they are probably used more generally in America than in England. The objection to all

these cartridge fuses is that they are very easily abused and rendered useless for their purpose. When once they have performed their useful function of breaking the circuit, they are frequently refitted with a thicker and harder wire, when they are of no further protection to the circuit and only serve to give a false sense of security. It is to overcome this objection that the "Zed" and "Dial" cartridge fuses have been designed. In these types it is essential to use the proper cartridge refills supplied by the makers.

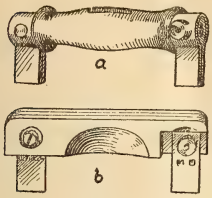


FIG. 9. PORCELAIN BRIDGE TYPE FUSES

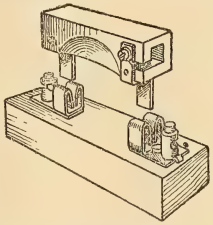


FIG. 10. SOLID BRIDGE TYPE FUSE

For small lighting circuits the commonest form of fuse used in England—so common as to be practically the only type used—is the porcelain bridge type. The "bridge" is sometimes tubular as in Fig. 9 (a),

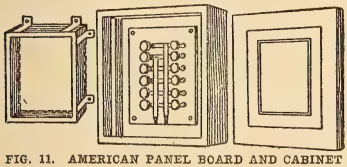


FIG. 11. AMERICAN PANEL BOARD AND CABINET

when the fuse wire is threaded through the open tube and connected to the end caps; but is more often of the solid bridge type as in Fig. 9 (b) and Fig. 10, in which type the fuse wire is exposed. The tubular pattern is, however, used for larger circuits carrying comparatively heavy currents of, say, ten amperes and over.

The fuses are always enclosed in some way and are generally grouped in a distribution box at a central point from which the branch circuits radiate. The English "distribution fuse box" is the equivalent of the American "cabinet" or panel board. The comparison between the two is shown in Figs. 11 and 12.

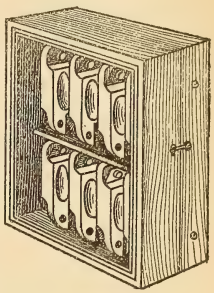
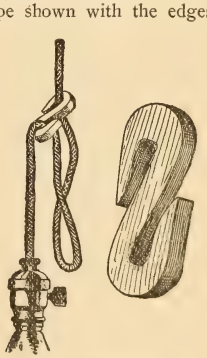


FIG. 12. ENGLISH DISTRIBUTION FUSE BOX

(To be concluded)

Cord Adjuster

A convenient cord adjuster used in a woodworking shop is here illustrated. A piece of ¼ inch hard wood is sawed into the shape shown with the edges where

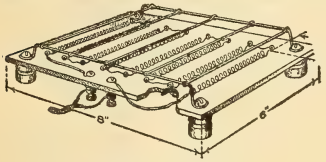

CORD ADJUSTER

the cord rests rounded off. This adjuster may be used on reinforced cord, but not upon ordinary drop cord.—W. R. Reynolds.

An Electric Toaster

The heating element is mounted on a piece of roofing slate 6 by 8 inches. Make holes as shown in the slate by drilling or chipping with a sharp punch.

For 110 volt service, cut off twelve feet of No. 28 Calido heater wire. In making the heating element for the



HOME-MADE TOASTER

toaster, wind the Calido wire around a piece of 3/8 inch steel rod, the latter being slipped out after the wire is wound, leaving a wire helix 3/8 inch in diameter and two or more feet in length, the latter depending upon how closely the turns are wound on the rod. The rod is simply used as a form on which to wind the wire. The Calido wire will retain its shape after the rod is withdrawn, if wound tightly and closely. In applying the heating element to the slate, the total number of turns in the helix should be counted or approximated and divided into eighths, so as to give about the same number of turns in each element.

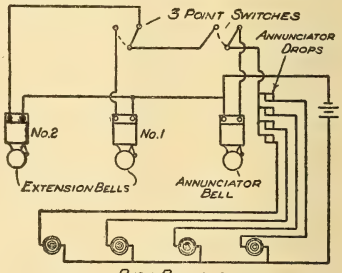
Cut sixteen pieces of No. 20 bare copper wire, 3/4 inch long, and fashion into cotter pins for holding the heating element to the slate. The heating element is held in the eye of the cotter pin, and then the latter is slipped through the hole in the slate. Porcelain insulators for supports and binding posts for the ends of the heater wire are shown. For a bread rack, bend two pieces of No. 16 bare copper wire into the shape shown. The bolts holding the insulators to the slate slip through the loops in the ends of these pieces of wire. Attach five cross wires to these two side wires. Place the toaster upon an asbestos mat and connect up by cord and plug.

WESLEY G. PAULSON.

Extension Bells for Annunciator

The writer recently had occasion to install a four point annunciator in a residence where many night calls had to be answered, and it was desired to have an extension bell from the annunciator in two servants' rooms, arranged so that one week one servant would answer the bell, and the next week the other servant would answer. It was also desired to have only one bell ring at a time and still have the annunciator show who the call was from.

A three point switch was placed at the annunciator, so as to cut out the annunciator bell and cut in the extension bell, and another three point switch was



WIRING OF EXTENSION BELLS

placed in one of the servants' rooms, which would cut out one extension bell and cut in the other one. The accompanying diagram will show the necessary connections to follow to carry out this arrangement.—CHAS. OLSSON.

Division Bell by "Wire"

"A certain Conservative club" in London is electrically connected with the division bell in the House of Commons, and members have found the arrangement most convenient.

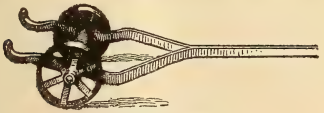
But Mr. Denman, the Liberal member for Carlisle, considers that it gives a party advantage to unpaired Unionist members, and he intends to ask the First

Commissioner of Works if he will terminate the connection.

The division bell rings in a number of members' private residences, including those of Mr. McKenna, Mr. Trevelyan and others within a certain radius of the Speaker's chair.

Truck for Handling Armatures

In electric railway shops it is necessary to handle heavy armatures. The accompanying illustration shows a truck used for this purpose. The wheels are thirteen inches in diameter on a 1⅞ inch shaft. The frame is made of 2 by ⅝ inch



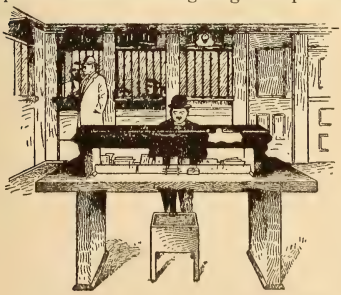
ARMATURE TRUCK

iron. The prongs of the frame are curved and spaced far enough apart so that they can be run under the armature shaft at each end. From the wheel shaft to the prong ends is eleven inches. The handle may be seven or eight feet long to secure good leverage.

Bank Lighting Hints

The economy of concentrating electric light upon the required object or place is coming into evidence more every day.

A Chicago bank uses an artistic, dull brass, trough reflector and tubular lamps placed therein for lighting the public writing desks on its main floor. The result is absence of shadows, no matter in what position the writer may be standing, and reduced current consumption with more efficient illumination.



ILLUMINATING THE PUBLIC WRITING DESK

Another convenience appreciated by the patrons is the illuminated numbers on the bank cages. These numbers are so placed and designed that they may be easily seen from any part of the floor.

High Furnace Temperatures

In the working of metals we now have the electric vacuum furnace, which carries us several hundred degrees higher than before. Beyond this, for many purposes, there is the furnace or crucible which, operating in hydrogen or in nitrogen and heated by a coil of tungsten or molybdenum wire, lets us melt practically anything. At present this type of furnace is limited only by the material of which the crucibles are made, and can easily be carried up to a temperature at which all the well known refractories much too easily melt. When one reflects that our industries have always depended on what could be done below a temperature of about 1,600° C.; that our porcelain mixtures, as well as our alloys, our metallurgical processes and all our applications of heat have been influenced by this upper limit, we look forward with interest to the effects which may be produced by making available a temperature at least 500 degrees higher in the next few years. Fundamentally new results ought to be anticipated.

Receiver Casings of Metal

For years the custom has prevailed of manufacturing the casing of telephone receivers of hard rubber or similar insulating material. Now, however, Mr. W. W. Dean, of Ohio, has designed a receiver of metal shell, the parts of which are made from sheet metal. Auxiliary metal rings are inserted at the point where the cap screws onto the shell. The end of the shell is reduced in size so as to slip within the external rings.

Atmospheric Electricity

In spite of the knowledge already gained the actual cause of the electrification of the atmosphere is, as yet, problematic. The causes can be friction in air currents, volcanic emission of charged

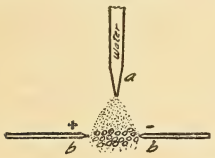


FIG. 1. SIMPLE EXPERIMENT, SHOWING FORMATION OF RAIN DROPS

gases, chemical activity, induction, ultra-violet light from the sun, and the bombardment of our outer atmosphere by electrified particles or electrons emitted by the sun and sent forth through space at tremendous velocities. The two causes last mentioned are of extreme interest because they are of recent origin.

Ultra-violet rays (sometimes called photo-chemical) are emitted by the sun in large quantities. Very little of this radiation reaches the surface of the earth because it is absorbed by the air. When absorbed it ionizes the air; that is, it breaks up the gases into ions of positive and negative charges. It can easily be shown that water vapor more readily condenses on the negative particles and therefore these might be carried to earth, leaving the air positively charged. The air is, however, sometimes negative with respect to earth. This can be explained by the phenomenon of electrostatic induction and accounted for in various ways.

The other method depends on the fact that hot bodies emit electrically charged particles. Thus the sun is supposed to send forth charged bodies consisting perhaps merely of electrons of electricity. These particles encounter no matter while traversing the boundless interplanetary space and are not absorbed or stopped until reaching our atmosphere.

Clouds are of course masses of very fine particles of water. When the air is charged it may be assumed that each tiny drop has a certain charge. As these drops coalesce and form larger drops it is a simple mathematical calculation to show that the potential of the large drop is greater than that of the small drops combined. This may account for the large difference of potential which suddenly breaks down the gap between cloud and earth. On the other hand, a simple experiment shown in Fig. 1 may be performed to show that the drop may be formed by the lightning discharge instead of vice versa. A fine spray of water is formed by the nozzle (A). A spark gap (bb) is placed in the spray and connected to a source of high electric potential. When a discharge passes between the points, the tiny particles of water coalesce and form large drops. It is thus seen that a lightning flash may be either the cause or effect of the formation of rain

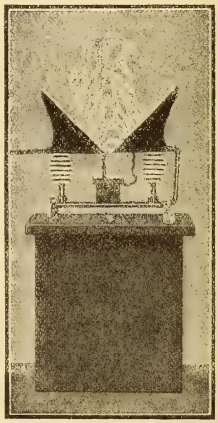


FIG. 2. DISCHARGE OF A LIGHTNING ARRESTER

drops. It is a matter of common experience that a heavy downpour of rain follows a lightning discharge, but owing to the much greater velocity of light than that of the falling drops it is impossible to determine which is the cause or effect.

The properties of a lightning discharge

are well known. It is oscillatory as is that from a condenser and its frequency is a million or more oscillations per second. Knowing this, it is useless to use solid conductors for lightning rods because an alternating current of high frequency does not flow in the middle of the conductor but confines itself to the portion near the outside. In other words, the resistance of a certain solid wire is much greater for high frequency current than for ordinary current. This "skin effect" becomes so important that the difference in conductivity of various metals becomes negligible and a galvanized iron pipe is a far better conductor of lightning than a solid copper wire of equal metallic cross-sectional area, but much smaller surface area.

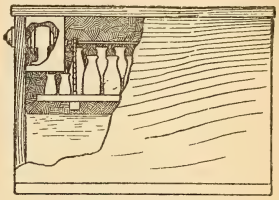
Owing to the high frequency of lightning current a few turns of wire offer a tremendous "choking" effect. This is taken advantage of in making lightning arresters for the terminals of telephone, telegraph and electric lines. A few turns of wire are connected into each outgoing wire just beyond the generator, telephone or other apparatus to be protected. Between this coil and the ground there are a number of spark gaps in series which ordinarily do not permit the current to flow across. If lightning strikes the line it meets great resistance in the coil and therefore jumps across the gaps to the ground.

There are many types of arresters, but they all contain the principle—an easy path to the ground for the high frequency discharge. Fig. 2 shows one form of arrester in action.

For the Milkman

A patent has been issued to Wm. M. Watson, Fallsington, Pa., upon a device for raising and lowering milk bottles in the milkman's cold water boxes used to chill the milk.

The apparatus consists of a rack, connected to small rods at the top of the ice box by chains or straps. These rods are connected to a small motor which when started will raise the rack and bottles above the water, allowing them to drain, still keeping them in the cold of the ice box. When the time comes for



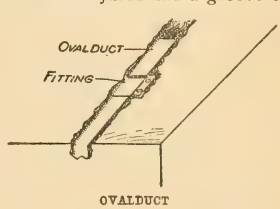
COOLING MILK BOTTLES

loading, they can be placed in the boxes and then in the wagon, entirely dry, yet cold, and the milkman has not suffered with cold fingers from picking several dozen bottles out of ice water by hand.

For the Electrician in Fireproof Buildings

In rearranging lighting circuits in fireproof buildings having partitions, walls and ceilings of plaster upon tile, the wireman has a new helper in the way of Ovalduct.

The insurance inspector does not like to have the tile injured and a groove chis-



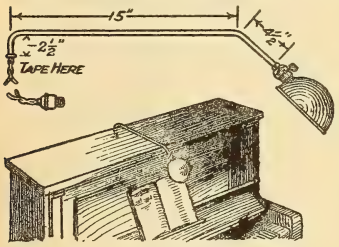
OVALDUCT

eled in the plaster is not deep enough to allow a conduit to be laid in, so lead covered wire has been used.

Ovalduct is piping like conduit, but is purposely elliptical in shape to lay next to the tile and be covered by plaster after the wires are in and the job done, thus satisfying both insurance man and building inspector.

A Piano Lamp

Procure a ¼ inch brass tube 24 inches long and thread one end to fit a standard socket. Wire the tube and socket, using three feet of fixture wire. Bend the tubing as shown in the illustration to lay

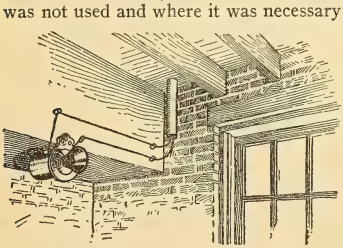


PIANO LAMP

over the top of the piano so that with a metal shade upon the lamp the leaves of music can be readily turned. Solder lamp cord with plug to the fixture wire, staggering the joints, and tape with rubber and friction tape. An eight candle-power lamp is bright enough to use.—ANTON PERTLE.

Automobile Horn for Factory Signal

Asked to install some sort of signaling device in a five story factory where steam was not used and where it was necessary



AUTOMOBILE HORN FOR FACTORY SIGNAL

to let the employes know when the machinery would be started or stopped, I made use of a Mesco automobile horn. The horn was installed on the third floor, near the stairway, and connected with the batteries and a push button in the office. The signals could be heard all over the building. The company recently moved to a place where it occupied two floors. The building had practically soundproof doors. I then installed a horn at the ceiling upon each floor, connecting the two horns in parallel.—CHARLES HORTON.

Farming by Electricity Demonstrated

Farming by electricity, as demonstrated at Beachville, Ontario, on June 25, by the Hydro-Electric Power Commission, is less than a chemical formula and more than a theory. It is a practical application of electricity as a motive power to the various branches of farming where labor is required. The demonstration was two-fold. It was the first effort of the commission to show the farmer at closer range just what the Ontario cheap power movement means to him. To the people of Beachville it was the tangible beginning of the participation of that village in the power scheme under the most recent legislation by the Ontario house.

Hon. Adam Beck took advantage of the occasion to make the announcement that the commission is about to order two portable threshing outfits, which will tour the country this fall to give demonstrations of the use of the power for this and other heavy farm work, such as corn cutting and plowing, where, say, 25 horsepower would be required.

The cost of such an equipment, Mr. Beck explained, would be about $1,000 less than the present threshing outfit; it would stand four times the service, and require no expert for maintenance. A meter would measure the quantity of power used, and the farms would be billed by the municipality.

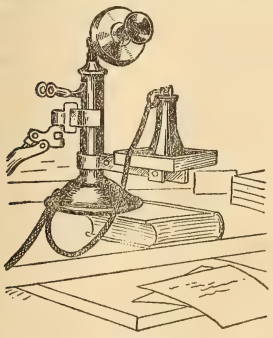
This announcement evoked universal interest, but equally practical was the statement that a supply of two horsepower of electricity would suffice for house lighting, milking, dairying, feed

cutting, cooking and the various incidental occupations where power in some form or other is required.

This demonstration, which started late in the afternoon, attracted some 1,500 people. Farmers from all sections drove in, anxious to see and to learn. While the demonstration was designed, from a farmer's standpoint, to bring the comfort, convenience and economy of electricity close to him in a practical way, many of the appliances displayed are familiar in city houses. The storage cooker, which is heated by electricity to 250 degrees Fahrenheit, and then shut off, holding its heat for hours, was put to some severe cooking tests. Chopping machines, feed and corn cutters and cream separators gave evidence of great labor saving possibilities. A center of interest was an automatic pump brought by Mr. Beck from Germany. It is operated by a one-sixth horsepower motor.

Tray for Telephone Receiver

There are few who haven't knocked the telephone receiver from the desk with



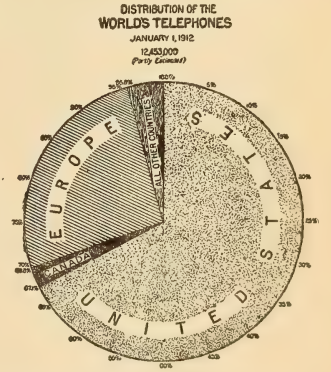
TRAY FOR TELEPHONE RECEIVER

the elbow when about to resume a conversation after looking up some needed information. I have found the small homemade wooden tray fastened to the standard of the telephone by a clamp a most convenient holder for the receiver at such times.—H. G. Wilson.

The World's Telephones

According to a recently published report of the American Telephone and Telegraph Company, it is estimated that on January 1, 1912, there were 12,453,000 telephones in use. The total length of telephone wires was 29,566,000 miles. At that date the world's investment in telephones is placed at $1,729,000,000. The accompanying diagram, which is reproduced from the above report, shows the distribution of the world's telephones, of which 67.1 per cent are in the United States.

It is worthy of note that during the year 1911 the great United States railway systems have made rapid advances



toward the general use of the telephone for train despatching. Since the introduction of the use of the telephone for that purpose, over 200 of the United States railroads have adopted that system. In fact the telephone has supplanted the telegraph on over 50,000 miles of railroad, which is over 20 per cent of the total railroad mileage of the country. A careful estimate places the miles of wire used by railroad companies for train dispatching at 120,000, and the corresponding number of telephones at 10,000.

Electricity the Silent Salesman

Some helpful hints on the use of electric current in getting up show window displays. The following schemes have all been used with remarkable success.

Garden Hose Display

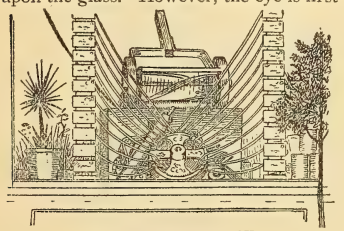
Two pillars built up of garden hose represent one dealer's method of calling attention to his stock. Between the pillars is set a searchlight upon the glass

CALLING ATTENTION TO GARDEN HOSE

of which is painted a picture of a gardener carrying several coils of hose over his shoulder and a plant in his hand. This picture in colors is made prominent by the rays from the light.

Grass Cutting Advertisement

The virtues of a lawn mower are presented in the window of a seed firm by means of parts of the mower, from each of which ribbons are run to cards pasted upon the glass. However, the eye is first

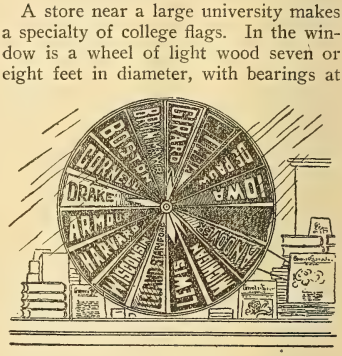


LAWN MOWER DISPLAY

attracted to the exhibit by an assembled mower. A small electric motor by running friction wheels, operates the machine.

Wheel of Flags

A store near a large university makes a specialty of college flags. In the window is a wheel of light wood seven or eight feet in diameter, with bearings at



WHEEL OF FLAGS

the hub. From the circumference of the wheel to the center are stretched flags of various colleges. On the shaft of the wheel is a pulley connected by a light belt to a concealed motor which operates this wheel of flags.

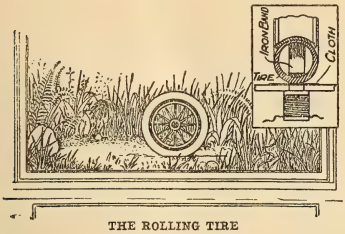
The Rolling Auto Tire

Nothing will so quickly attract the attention of passers-by as some mechanism whose operation borders on the mysterious. An apparently simple device of this nature is being used to advertise automobile tires.

The whole length of a large window is backed with an artistic arrangement of palm leaves and shrubbery. Just in front of the shrubbery is left a narrow space about six inches wide, covered with ordinary blue overall cloth. At each end of this narrow path are placed two large stones and between them, without any apparent means of support or power, rolls an ordinary automobile tire.

The secret of the device lies in a system of electro-magnets arranged at inter-

vals of about two inches and concealed beneath the path. These attract a band of iron placed inside the tread of the

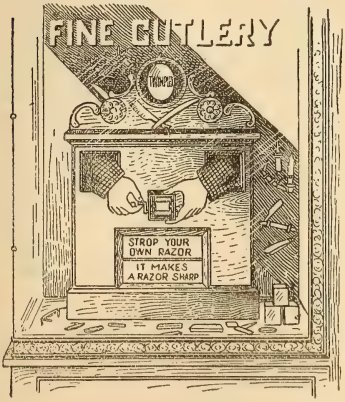


THE ROLLING TIRE

tire. The poles of the magnets terminate in innocent looking heads which appear merely to hold the cloth in place. By contacts controlled by a concealed motor the coil of one magnet after another is energized, rolling the wheel back and forth.—STUART R. WARD.

Demonstrates Safety Razor Blade Sharpener

The use of safety razors has brought out numerous devices for sharpening the blades. A show window display calling attention to one of these mechanisms is here shown.

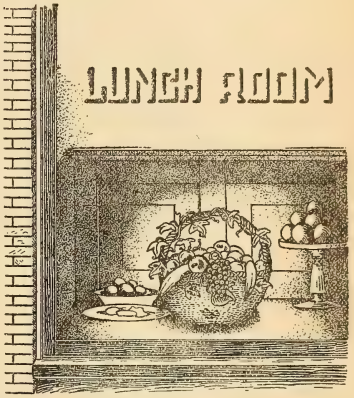


SAFETY RAZOR DISPLAY

The right hand which turns the device is operated by a small motor inside the case, as is also the "twirler" on top.

A Basket of Glowing Fruit

An enterprising Chicago restaurant owner is using for his show window a large basket containing sockets into



LUNCH ROOM ATTRACTION

which are screwed bulbs representing a large variety of fruit, so placed and arranged as to form an appetizing as well as an artistic imitation of a basket of fruit.

Emphasizing Window Displays

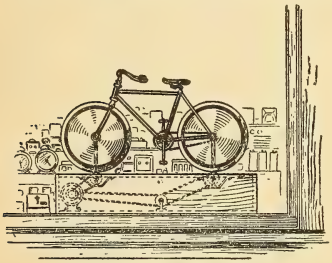
A clever method of calling special attention to certain items in his show windows is being used by a prominent dry goods merchant at Cleveland, a man who long ago learned the advantage of adopting tungsten lamps with suitably shaped reflectors for lighting his window displays. Although well pleased with the resulting window illumination, he found that the lighting made all of the goods show up equally well. What puzzled him was how to call special attention to certain items in the window without marring the artistic effect by unsightly signs.

This he has now done by placing additional tungsten lamps in the windows, with reflectors concentrating the light from each on a certain article. These added lamps have colored bulbs and are turned on and off at short intervals by little flashers. Consequently, the man or woman looking into the nicely arranged and brightly lighted window suddenly sees a table spread turn pink; then a morris chair near the other end of the window changes from brown to green in its tints, and so on.

Watch the Wheels Go Round

That an ordinary bicycle should attract attention as a window display would seem unusual, yet arranged as shown in the illustration it proves a drawing card.

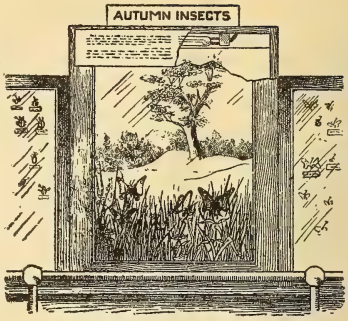
The machine is mounted upon an elongated box through the cover of which are two grooved wheels, each touching the rubber tire upon a bicycle wheel. A concealed electric motor turns the driving wheels, causing the bicycle wheels to spin around.



MOVING BICYCLE DISPLAY

Butterfly Exhibit

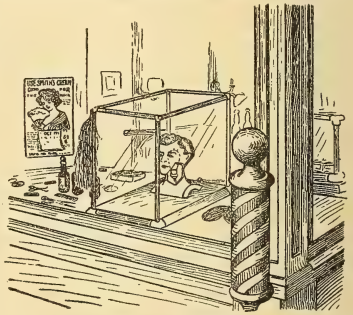
In a portion of a museum devoted to insects, electric light is used to bring out the beauty of the butterfly specimens. A glass case with its sides and back holds a picture, in natural colors, of flowers and distant woods. In the foreground artificial grasses and flowers are placed, and upon these are the butterflies. The richness of the scene is heightened by light from incandescent lamps hidden from view in the upper front part of the cabinet.



BUTTERFLY EXHIBIT

Wig Advertising

A wig manufacturer attracts attention to his show window by placing within a wax head wearing a wig a low candle-power incandescent lamp. The light gives a live glow to the wax figure and, according to the manufacturer, helps sell his goods.



WIG ADVERTISING

On and after June 1, 1913, New York City wiring rules will prohibit the use of wooden molding for enclosing electric wires.

Electrical Securities

By "CONTANGO"

In this and the succeeding article a brief review of the past ten years or so will be given, containing some extraordinary facts and figures concerning what has been done, is being accomplished and is likely to be achieved in the future.

It is not the purpose here to give a long list of figures or dry-as-dust details that nobody will read, but rather to show some pertinent facts and illuminative illustrations as to just what has been accomplished in, say, the last ten years, and, to use a homely phrase, show "what is doing" and what will be done in the world of electrical finance.

One might make the statement right here that now over, and considerably over, $2,000,000,000 is invested in one way or another in the lighting and power development of an electrical character in the United States.

It would be just as well to quote here the words said in 1909 by the president of the National City Bank of New York, itself one of the greatest, if not the greatest, of financial institutions in the world. For he spoke then from the fore-knowledge of an individual trained to watch the best possible opportunities for his customers and indeed all those people who, being not afraid to part with their money, are alive to good and certain returns on it. Moreover, the facts have more than borne out his words. Let us see.

In 1909, to quote Mr. Vanderlip: "The eleven or twelve hundred million dollars which are today invested in electric lighting and power plants form an investment that is divided between some eight or ten thousand separate companies. That in itself is one of the important reasons why we find such a small number of electric light securities in the bond lists of the great stock exchanges. The average cost per plant, as given in the census report, was about $140,000, in 1902; in 1907 the average cost per plant was a little over $200,000. We had a situation then in which there was a great number of small individual plants unrelated in management or incorporate in organization."

Now, we will for the moment leave Mr. Vanderlip's remarks to themselves to suggest that in the three years past since he uttered them, there must have been an additional investment of rather over $900,000,000, and in proportion as this great sum of money has been put forth, just so has the tendency been to decrease the number of small plants, consolidate them into large ones and increase the cost per plant.

To quote Mr. Vanderlip once more: "We have seen the electric lighting business grow more rapidly than any other form of industrial activity. A business that will double in five years, as the electric lighting business has done, has in it a vitality that is, of course, bound to carry it to enormous proportions. The great development in the use of electric power offers a field of growth that seems likely to be quite as rapid as has been the development in the illuminating field."

Again, it is wise to interrupt Mr. Vanderlip's utterances of 1909 to tell you that this development in the field of power, about which he speaks, has been far, far greater than he ever anticipated. To conclude his salient and brilliant remarks:

"Given intelligent technical management, conservative accounting that embraces ample charges for renewals and depreciation, fair rates that do not offer a field for legislative attack, I see no reason why sums in the most ample supply should not be found to absorb all the securities of this kind that it is necessary to create. If, added to these elements, there are corporate combinations,

which are made for the purpose of taking advantage of legitimate economies, and not for raising rates, combinations that will result in single issues of large volumes so as to give the investor marketability as well as security, then funds should be had for electric development not only in ample supply, but at a moderate rate of interest."

One would like to write in here, before going further into this matter of accomplishment, a very recent cablegram from London, one which may be said to reflect the financial tendency of the day. It reads as follows: "In the line of speculative investments there may, and is likely to be from now on, a great development of interest here in the public utility companies of the United States. The opinion is growing in this country that owing to the better supervision under which their finances are conducted, such investments offer better possibilities in the United States than they do in England. These investments have been to a certain degree neglected hitherto on this side of the water."

Now, as to this London opinion, let one suggest that in a large measure the public is guaranteed against that dangerous tendency which in other fields for the exploitation of capital has laid many corporations low, by supervision on the part of commissions, state or otherwise, and local boards. Serving, as these corporations must, communities with a necessity that enters intimately into the comfort and prosperity of its citizens, it naturally follows that the leaders of such communities are extremely careful to see to it that those to whom are granted valuable concessions in the form of franchises do not abuse them, or use them to their own enrichment, without returning to the people upon whose patronage they expect to prosper a full measure of value.

Statistics have at least clearly shown that up to the present time public service corporations, taken as a class, have shown the cleanest and most consistent records of all the diversified forms of corporations. They are singularly free from exploitation by stock jobbers, except in isolated cases. Fewer financial disasters have marred their progress. They have passed through a number of panics and periods of depression without as much as having their growth even stunted, and for this exceptional expansion there is only one possible explanation—the fact that they deal in indispensable necessities, which are retailed for comparatively so small a sum that any one may use them.

To plunge right into the middle of the matter in hand, let us say this:

There is today a pronounced tendency toward the consolidations of small electrical properties into large holding companies for the benefits to be derived therefrom in the economy and efficiency of management.

History shows that in such consolidations the holders of bonds and shares of small properties receive very advantageous terms, resulting in material profit as a result of their earlier purchases of the small properties.

The point to be taken is the advisability of the investor purchasing securities of growing public service corporations early in their career, and then the opportunity for enhancement of values is the greatest. But there is, too, a word of caution, that in making such selections it is primarily of the greatest importance that the investor should be guided solely by the advice and suggestions of conservative bankers. Time and time again, leading up step by step, you have been given information how you should be guided in this important particular.

It must never be overlooked that notwithstanding the success which has attended the development of public service corporations, there are also some weak propositions; some that grow too fast and which in their growing period are not strong enough, and they succumb only to be overtaken by stronger corporations. Because of this tendency,

you must be careful not to assume that the mere fact of a weak corporation being taken over by a stronger one, of necessity means you will be the gainer by the proposition. Doubtless you would be if you had the securities of the greater and, as has been pointed out just a few lines above, you will be if you are wise in your selection of the small ones.

And once again let it be reiterated, it is in the management and in the names associated with such enterprises that you will find your greatest salvation.

Hardly a week has passed in the last two months or more without the announcement of a new holding company to take over the control of a number of new operating public service corporations. Most of these corporations started off on a large scale, and have in turn acquired large and well known public utility properties. This steady development in centering the control of traction, light and gas companies, under one management, pertinently reflects the evolution that has been steadily and silently taking place in late years toward concentration. Precedent and the success which in this particular field have attended former efforts along these lines are, of course, responsible for the organization from month to month of new holding companies, which have of late been so very numerous.

The examples of what it is possible to accomplish through increased earnings and reduced operating expenses supplied by the American Light & Traction Company, the Electric Bond & Share Co., the American Gas & Electric Company and other companies have been so marked that a desire to emulate them has proved irresistible to others. But again be it observed, remember names.

If this progress continues steadily, it will not be so very long before nearly all the successful public service operating companies worth the while of acquiring will be safely domiciled under the wing of one or another of the strong holding companies. This is more significant than might appear on the surface, for if you trace one small company through its history into its absorption by a larger, and the larger into that of the still greater, you will find that they reach clear through to the very fountains of business management, integrity and capital which must and has to protect your money. You are therefore safe. You know exactly with whom you are dealing.

Some few facts may be given here concerning what may be called the premier public utility corporation of this country. The stock of the American Light & Traction Company sold in July of this year at 400. That is to say, at a figure 400 per cent greater than its original price. The company's common stock outstanding is less than $12,000,000, while the company has a surplus of upwards of $8,000,000. This will no doubt be distributed some day and share holders think that the distribution will be made very soon. This is not by any means intended as a "boost" of something that needs no "boosting," but is merely an illustration of what has been accomplished along this line.

Or again we might take the case of the American Utilities Company, which recently made a public offering of $750,000, six per cent preferred stock, with which went a bonus of $290,000 common. The offering was subscribed more than three times over and a common stock, on which the indicated earnings for the coming year are $7.25 and over, advanced in price accordingly, while the preferred also, rightly enough, advanced many points over the quotations of a few months previous. This again is not intended as a "boost" of this company in particular, but merely as another illustration.

We might take again the City Service Company. At the last report submitted the year's surplus was $274,556 and the total surplus up to June 30th last was $465,354.

As before said, dry-as-dust statistics which you will never read is not the pur-

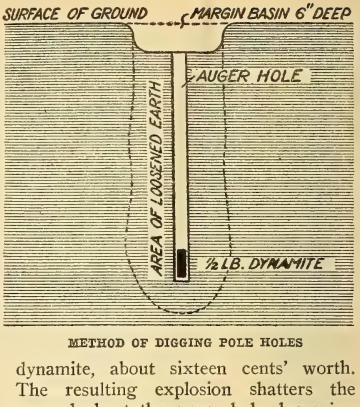
pose here, but startling figures and facts are: We had the intention to supply in detail the figures of electrical financial development in the United States during the past decade, but they were found to be too voluminous, too all embracing, for even a small portion of many articles; they would demand a volume all for themselves. But we can give some figures relating to that parent company mentioned which has its headquarters in the greatest electrical center of the world, and here they are: Speaking at the celebration of the twenty-fifth anniversary of the inception of this company, the Commonwealth Edison Company of Chicago, in June last, the president observed that in 1889 the income from light, power and railway was $105,700; in 1899, $1,792,700, and in 1911, $13,902,300. In 1893 this company had 4,100 customers; in 1899 it had 13,300 customers; in 1911 the number of customers was 157,115. What more need be said?

But you who live in the midst of such things have been told bit by bit what values are, how they are derived, why they are so termed. Therefore, after giving you all this information with the expressed willingness to give more, you must accept the homely dictum of saying surely "It's up to you."

Digging Pole Holes with Dynamite

Experiments made by the Marion (Ind.) Electric Light Company with dynamite for opening pole holes in frozen ground indicate, says the *Electrical World*, that the explosive reduces the excavation cost from $1.75 to about 35 cents per pole, besides enabling one gang to dig sixteen to eighteen holes a day.

In preparing for the dynamite a little basin six inches deep and the size of the hole is first opened at the surface of the ground to prevent the explosive action from spreading. Then with an auger a two inch hole is bored to the desired depth of the excavation, and into this hole is dropped a half-pound stick of

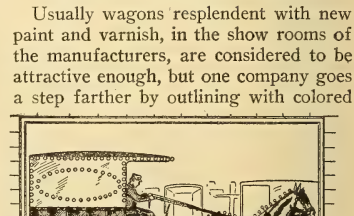


METHOD OF DIGGING POLE HOLES

dynamite, about sixteen cents' worth. The resulting explosion shatters the ground about the auger hole, loosening the frozen earth at the surface up to the margin of the basin first cut. This loosened earth in the hole can then be "spooned" out easily and the hole is ready for the pole. In making preliminary tests in frozen ground it was necessary to set off two half-pound charges at different depths for each pole, but with unfrozen ground one 16-cent charge was enough.

Attractive Wagon Display

Usually wagons resplendent with new paint and varnish, in the show rooms of the manufacturers, are considered to be attractive enough, but one company goes a step farther by outlining with colored



WAGON DISPLAY

lights a lifelike exhibit of a horse, wagon and driver and placing the outfit in a window bordered with similar lights.

Inventions and Patents

By A. P. CONNER

II.—THE PATENT OFFICE PROCEDURE

The next important step is the filing of the application in the Patent Office, which includes the payment of the preliminary government fee of $15. This preliminary fee must be paid in advance, as the Patent Office cannot accept the application until it is. If there are no informalities of serious consequence, the application is then sent to the classification division, which assigns it to the examining division to which it belongs. When its turn comes the examiner to whom it is assigned takes it up and examines it and particularly its claims to determine its patentability. An extensive search is made through the Patent Office records, which include all the domestic patents and those of foreign countries, together with catalogues, text books and all other sources of information which might serve to show all that has been done in the way of invention. This is in order to safeguard against the allowance of a patent that might be declared invalid. It is ridiculous to imagine that the Government will allow a double patent for the same invention, under the present system, especially if the difference between them is only a slight mechanical one, although many lay people seem to think otherwise. In order to obtain a patent in the United States at the present time the inventor must show that his invention is fully within the terms of the law and has merit. This is further emphasized by the fact that the examiners are men of high technical and legal training and fully capable of seeing through any schemes that might be perpetrated for the purpose of getting a patent without deserving it.

When the examiner discovers a reference which conflicts with the applicant's claims, he officially notifies the applicant or his attorney, who then suitably amends them until the case is placed into condition for allowance. When the application is allowed it is passed to another division which then sends out an official notice of allowance to the inventor, and notifies him that on payment of the final fee of $20 his patent will be granted and passed to issue. Six months after the date of allowance are given the inventor, in which to pay the final fee, so that he may be able to do it, no matter how humble his circumstances. After paying the final fee the inventor receives a copy of the patent specially printed for, and provided with the Patent Office seal and at the same time a number of the patents are printed so that the public may obtain copies of it. These copies of patents cost five cents each. At the same time a synopsis of the patent is printed in the Official Gazette of the Patent Office, which costs ten cents a number and which is issued weekly on Tuesday.

If the examiner thinks an invention is unpatentable, he so notifies the inventor or his attorney, and gives him an opportunity to prove otherwise, and then if he still is unconvinced, he rejects the application. If the inventor is not satisfied with the examiner's decision he has the right to appeal to a special board of examiners selected for that purpose, and if they do not reverse the opinion of the examiner, a further right to appeal to the Commissioner himself is given, and from thence to the Court of Appeals of the District of Columbia. This gives the inventor all the opportunities necessary to get the protection he seeks, provided he is not satisfied with that given him in the Patent Office.

If two or more independent inventors happen to make independent application for a patent covering the same invention at the same time, and each invention is deemed patentable, an "Interference" is declared, which is in short a proceeding to determine who is the first inventor of the invention. When this is found out

a patent is granted to the person who is the first inventor.

There are many technicalities which arise in the procedure of the Patent Office, which while important cannot be referred to in an article of this kind, particularly as their meaning would not be clear to the reader unless he had the actual practice and experience to assist him, but there are several important principles which should be known by all, for instance, only the inventor can make application for patent, and in case of death his administrator, and the patent will be issued in his name. If others wish to have their names appear in a patent, they must obtain an interest in the same, and have said interest recorded at or before the time the final fee is paid into the Patent Office; in which case it will definitely appear that they are assignees of the patent, together with the interest they have in it, on its face. Where anyone has obtained an interest in a patent, he should see that it is duly recorded in the Patent Office, as such action on his part will in most cases be the only proof he can offer to the courts that will be considered, in case it is necessary that he should do so. However, if the applicant is guided by a competent patent attorney he will be fully advised in all these matters, so that his interests will be protected.

SELECTING A PATENT ATTORNEY

The selection of a patent attorney is too important a matter to be lightly considered, so that a few words of suggestion seem advisable. It must be remembered that many inventions are worth tens of thousands of dollars if properly protected, and sometimes millions. As this is so the inventor should use as much caution in selecting his patent attorney as he would in selecting a trustee to take care of an estate of that value. If the patent is once passed to issue it is almost impossible to get additional protection on the invention than that already provided for in the claims in the same. If same are drawn with a lack of care and skill it means a loss to the inventor, for which he cannot get redress, because he is presumed to use proper care in the selection of his attorney. Every particular case has to be considered by itself, but the following general rules may assist the reader in this matter. If the inventor has an invention developed on electrical lines, he should choose an attorney who has had particular training along these lines, or who has specialized in the same, because their technical scope is far beyond that which an ordinary patent attorney is able to efficiently deal with. Usually any of the attorneys who have been employed by any of the large electrical corporations, such as the General Electric Company, Westinghouse Company, etc., and those in Washington who may be well known as experts in this line are particularly desirable for this class of invention.

It must also be kept in mind by those who wish to sell their patents that the name of a reliable patent attorney counts for a great deal in the consideration that it will receive at the hands of the patent experts of the corporations with whom they communicate. If the name of an attorney of high class prestige appears on the papers of an application, it assures those who are to be buyers of the invention that proper care and prosecution has been given it and that no further investigations on that part are necessary.

THE COST OF A PATENT

The cost of patenting an invention varies with the circumstances, but those of a simple nature cost in all about $70 to $100, which is divided somewhat as follows: The preliminary government fee of $15; the cost of each sheet of drawings, $5; the final fee of $20 for the government, and $35 (up) for the attorney's fees. However, conditions may vary these figures, but they form a good general basis as to what they are. In conclusion it may be said that the time for patenting really meritorious inventions was never better than the present, especially if same have some important feature that cuts down the cost of operation of the device, or its cost of manu-

facture, particularly if there is keen competition in the use of the machine.

COMMERCIALIZING THE PATENT

There are two ways in which a profit may be made out of a patent. The first and quickest is selling the same outright to a buyer, and the other is in the manufacture or marketing of the device by the inventor himself. The latter is oftentimes the most profitable but slowest in the point of realization. In selling the patent to a corporation two general methods are ordinarily pursued. One is to pay a cash price to the inventor and thereby settle the matter forever as far as he is concerned, and the other is to pay him a certain amount on every article embodying his invention manufactured, which is called the royalty basis, and is often the most equitable for all concerned. But the great doctrine of success in the production of inventions is very aptly expressed in a motto commonly used by Thomas A. Edison, which is "Everything comes to him who hustles while he waits."

NEW BOOKS

THE PROGRESS OF PHYSICS. By Arthur Schuster. London: Cambridge University Press (New York: G. P. Putnam's Sons). 1911. 159 pages. Price, $1.25.

A series of four lectures delivered to the University of Calcutta, India, March, 1908, and revised to bring the subjects to their position at the present time, such as The Theory of the Atom, Elastic Solid Theory of Light, Roentgen Rays, Terrestrial Magnetism, Atmospheric Electricity, Gravitation and Identity of Molecules of the Same Kind.

ELECTRIC METERMAN'S HANDBOOK. By the National Electric Light Association, New York. 900 pages with 750 illustrations. Price to members, $2.00; to non-members, $3.00.

This book should be of value to all company and individual members who are interested in the measurement and sale of electricity, as it contains practically all authoritative information required by any one in charge of the operation of electric meters, from the standpoint of the executive, the installation, or the testing department, and for the guidance of civic commissions.

PLANS AND SPECIFICATIONS FOR WIRELESS TELEGRAPH SETS. Part I. By A. Fredrick Collins. New York: Spon and Chamberlain. 1912. 47 pages with 37 illustrations. Price, 25 cents.

The purpose of this booklet is to describe and illustrate two different sized wireless telegraph sets, so that anyone having a little knowledge of electricity can successfully make them. A set for experimental work is described and also a one to five mile set.

THE BIOSCOPE ELECTRICIAN'S HANDBOOK. By James W. Barber. London: Ganes, Limited. 1911. 47 pages with 27 illustrations. Price, 27 cents.

The author says, "It is hoped that this book weighing not much more than an ounce will afford the operator a ton of information."

AEROPLANE DESIGNING FOR AMATEURS. By Victor Lougheed. Chicago. Reilly & Britton Company. 161 pages, with 82 illustrations.

Taking exception to the plea that the principles of aeroplane design are too uncertain, the author seeks to present a treatise in which the laws of aviation shall be presented in the manner accorded any other branch of engineering. Among the chapters are: The Wing in the Air, Equilibrium and Control, The Design of the Machine.

WIRELESS TELEGRAPHY AND TELEPHONY. By C. I. Hoppough. Valparaiso (Ind.): C. M. Dodge. 1912. 227 pages with 149 illustrations. Price, $1.50.

A treatise in which is set forth in as understandable a manner as possible a few of the fundamental principles of wireless telegraphy, accompanying these by applications to the solution of practical problems which arise daily.

TELEPHONE TROUBLES AND HOW TO FIND THEM. By W. H. Hyde. Milwaukee: W. H. Hyde & Company. 1912. 56 pages with 22 illustrations. Price, 25 cents.

An endeavor to present telephone construction, troubles and remedies in plain language in a compact reference book. One chapter is devoted to Phantom Circuits and How to Install Them.

SCIENCE EXTRACTS FROM FOREIGN JOURNALS

ELECTRICAL DEMONSTRATION FOR FRENCH FARMERS

France is not behindhand in the use of modern electric devices on the farm. Not long ago there was held an exhibition at Amiens which was intended to promote interest in the subject throughout the region, and one of the interesting points was a model farm with nearly everything run by electricity. Here were to be seen electric kneaders, different kinds of grinders or crushers, also washing devices for farm products, root cutters and straw cutters and breakers for hard substances. Other farm implements were electric threshing machines, wood saws, cider mills, also a freezing plant and others of the like. In this way it was shown that all the farming operations could be done in the very best way with as little hand work as possible and naturally the operations are much cleaner and the health is likely to suffer less. The electric devices would thus make farming a pleasure.—*Journal (Daily), Paris.*

WIRELESS ON FERRY BOATS

Passengers now make the trip from the Continent to Norway and Sweden without leaving the railroad cars, as these are taken across in large ferries. Wireless telegraphy is now to be used so as to keep up connection with the shore, and the ferry service between Sassnitz, Germany, and Trelleborg in Sweden will be the first to use it. On the German side is a wireless station with two 120 foot masts, and on the other coast is an iron tower of 130 foot height with an antenna of umbrella form. The German ferry boats "Preussen" and "Deutschland" are fitted with wireless outfits of a suitable kind. The new service is likely to be very useful, for not only are the two shore posts able to send messages about trains which may be late, or the arrival of freight trains and the like, but the ferry is also in connection with the shore and can have all the needed information. It can also signal about fog or ice and notify the shore posts of any delays which are due to this cause. In one case the boat met with ice and had to change its course and was then lost in the fog. It was able to find its bearings by means of wireless and soon after that it came in to the port of Sassnitz.—*Revue Scientifique, Paris.*

GYROSCOPE EXHIBIT

At a recent meeting of the Royal Society in London there were exhibited a number of electrical gyroscopes by Drs. Gray and Burnside. The larger ones had electric motors of the Gramme ring type and were suspended from frames or otherwise fitted for demonstration purposes. A striking use was offered in a gyroscope mounted on a bicycle saddle and fitted with a yoke or cross bar connecting to the handles. The gyroscope acted to steady the bicycle and gave an automatic control when moving forward. If the machine tended to fall on one side or the other, the effect on the handle bars gave the needed impulse to check up this movement and bring the machine back to the upright position, so that the bicycle was self righting.—*Engineering, London.*

ELECTRICAL RAILROAD SIGNAL

The idea of using the passing train to work a railroad signal is not a new one, but none of the pedal devices or the like which have been proposed seem to work in practice. A new electric method is used in a German apparatus which was built some time ago. It makes use of the slight sinking of the rail when the train passes. The idea is a simple one and consists in the use of two metal chambers filled with mercury, but one chamber or

cylinder having 1,500 times the surface of the other. The large chamber is used so that the rail acts to press down on the mercury in the large chamber and the least movement of the rail causes a considerable rise of mercury in the small one, just as in a hydraulic press worked backwards. When the mercury rises, it acts on a suitable device so as to close a switch and put on an electric current, either continuously as long as the train passes, or during the passage of each wheel. The new apparatus is ingenious and simple, and the moving parts are substantial and will not suffer damage.—*Revue Scientifique, Paris.*

DAMMING THE HISTORIC RHONE

A few years ago it was considered almost an Utopian idea to bring power from the Rhone river to Paris, as the distance is no less than 300 miles. However, the progress in electrical work has been so great that the project is meeting with much favor and is now almost on the point of being approved officially. The power plant will be by far the largest on the continent, as it will give 300,000 horsepower, and at the present rates for current this means a yearly revenue of nearly $30,000,000. Such an amount of power can be represented by 6,000 trains of coal of 400 tons each. The dam will be across the Rhone at a point not far from Geneva where the river flows out of Lake Leman. At Genissat the river follows a veritable cañon, and the dam will be over 300 feet in height and the same width at the base, and it will cost $2,000,000 alone. This will back the water up in a vast lake of fourteen miles length, submerging three villages. At the dam will be erected a turbine electric plant with turbines of 20,000 horsepower capacity. From the station will be run power lines to Paris, and it will operate at 150,000 volts, very likely.

There will be used four different pole lines, so that a local accident will not cut off the current. In this way the city of Paris will receive a large supply of current for lighting or for electric traction and other purposes.—*Revue Scientifique, Paris.*

RADIUM RAYS FROM GAS MANTLES

Although the rays which are known as radium rays are given off to a greater degree by preparations of radium, there are other substances which also give the rays to a less extent, as is well known. Mr. Edgar Senior brings out the fact that the ordinary gas mantle contains quite an amount of oxide of thorium, which is one of the ray producing bodies, and he makes the rays act on a photographic plate so as to give an impression or print of the threads of the mantle. Some of the gas mantles are nearly all made up of the thorium oxide, so that they will give quite a marked effect, and an amateur can easily repeat the experiment. All that is needed is to wrap a photographic plate in thin paper, and on the paper is laid a flat piece of the gas mantle so that it can act on the gelatine side of the plate through the paper. The whole is put in a tin box and this is placed in a closed cupboard. At the end of three weeks the plate is developed, and the woven threads of the mantle are very clearly seen upon it.—*Cosmos, Paris.*

INTERNATIONAL WIRELESS CONGRESS

The International Wireless Telegraphy Congress held at London on June 4 presents much of interest, and all the leading nations were represented by delegates. Three of the questions discussed are specially important just now, one of these being the organizing of the wireless time signal service, and another, the question of messages between fixed stations. A third matter which now needs to be regulated is that of wireless apparatus on aeroplanes or airships. The time service for vessels is in use by France, America, Germany and Italy, but the Eiffel Tower and the Nauen post in Germany, for in-

stance, interfere with one another, so that some rules are needed in order to have the service working properly. Now that airships and aeroplanes are beginning to use wireless apparatus, there is need for special rules as to this point, and also some standards for apparatus should be fixed upon. The last congress thus proved of benefit in taking steps toward the regulation of some of these questions. —*Matin, Paris.*

DANISH PROFESSOR'S NEW BATTERY

Professor Hannover, who is an eminent Danish scientist and at the head of the Copenhagen Polytechnic Academy, has just devised a new type of storage battery cell, and it is claimed to have the lightest weight for a given power which has been yet found. For an equal size and weight, the new cell gives five times as much current as an ordinary storage cell with lead plates. The essential point about Prof. Hannover's cell is that it uses a porous alloy of lead which is obtained by a special process, and to this he gives the name of "porous metal." In this way the lead plates of the battery have millions of pores of microscopic size, so that the yield of the battery is increased in proportion to its weight. He considers that his new cell will be of great service in all the cases when a light weight battery is needed, as, for instance, upon airships and aeroplanes, as well as on submarines, also for the lighting of railroad trains.—*L'Electricien, Paris.*

FRENCH DE-TINNING PROCESS

Capsules for bottles are usually made of sheet lead having a very thin coating of tin on one or both sides so that the tin will give the bright appearance which is noticed. But as tin is an expensive metal, inventors are looking for a good means of separating it from the lead so that it can be used over again. The tin recovered from old capsules would thus represent a considerable value. A Paris engineer, A. Nodon, is using an electric method for recovering the tin. He dissolves it off the lead in an electric bath, as a purely chemical bath would also dissolve the lead and is much harder to work. He puts the waste capsules in perforated boxes and places these in a tank with plates of lead on the other side, after the battery principle, using a suitable solution. Then he passes a current in the tank between the lead plates and the metal of the capsules so that after a time all the tin is dissolved off. The tin remains in the solution and it can easily be extracted by chemical means. The lead part of the capsules is then ready to be melted up and used over again, so that both the tin and the lead are recovered.—*Cosmos, Paris.*

THE "OCEANIC LETTER"

Experiments are being made on one of the Hamburg ocean liners with a method of combining wireless telegraph and postal service so as to give the public the benefit of what they call the "oceanic letter." The message is written by a passenger on board an outward-bound steamer and is intended for a person on the continent. It is given to the wireless operator on board, and when he is able to make connection with a steamer going in the opposite direction he sends the wireless message, with the proper instructions. The message is taken down on a special telegraph blank and when the vessel arrives at port the telegram is turned into the ordinary mail and thus arrives at its destination. Experiments were made on board the steamer "Cape Arcona" of Hamburg, and it was found that sometimes the messages gained eight or even fourteen days over letters sent by the usual postal method. The price is $1.20 for a 30-word message, and this is much lower than for over-sea wireless messages, the rate being 24 cents a word. It is thought that the present idea would be a most useful one and could be followed according to an international agreement, and no doubt lower rates could be made.—*La Nature, Paris.*

On Polyphase Subjects

Vail Gift to Boston "Tech" Library

A library of 30,000 volumes on electricity and electrical engineering, valued at $100,000, has been presented to the Massachusetts Institute of Technology by Theodore N. Vail, president of the American Telegraph and Telephone Company. The library was collected by the late George Edward Dering, and is considered to be the most complete of its kind in existence.

Cheap Fuel of the Bad Lands

The Bad Lands of North Dakota embrace miles upon miles of the most wretched landscape on the face of the globe. Desolate hills and miniature mountains of cinder-shot clay stretch away in all directions, absolutely barren and waterless except during a few favored months in the spring. It looks as if at some time the whole country was a bubbling clay pot. Indeed, this is one theory for the curious formations, for the whole land is underlaid with lignite coal, which is supposed to have been on fire at one time until water from the rivers got in and the whole face of the earth blew up.

There are still vast quantities of this lignite cropping out into sight on most of the hills. It has high heating value as long as it is moist, but as soon as it dries out it rapidly disintegrates; therefore, it is unsuitable for shipment. There it lies, of use only locally where it can be mined and burned during the winter, when moist.

Robert H. Fernald, consulting engineer of the Bureau on Gas Producer Practice, in a recent paper has something to say along the line of utilizing these coal products, and some quotations from the paper are here given.

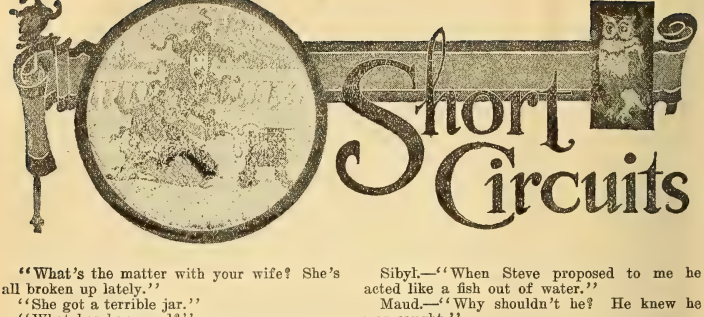
"Investigations into the possibility of generating producer gas for power purposes in a commercial way from the various mineral fuels of the country have been carried on for some time by the United States Government. These investigations have been associated with steaming, briquetting, coking, and other tests, all of which supplemented an examination into the nature, extent, and distribution of the fuels used.

"Many States of the West that have no good coal are also greatly benefited by the investigations, which have shown the adaptability of the gas producer for the utilization of low grade coal, lignite, peat, etc.

"In States in which deposits of low grade coal, lignite, and peat are found, the present cost of power, as developed in steam plants with coal that has been shipped a considerable distance, can be materially reduced by placing producer plants at the mines or bogs, so as to utilize these low grade fuels without cost of shipment by generating electric current which can be easily transmitted to desired points within a wide radius.

"It was found that the low grade lignite of North Dakota developed as much power when converted into producer gas as did the best West Virginia bituminous coals burned under the steam boiler."

In view of these facts, it is not unreasonable to suppose that some future day will see the Bad Lands a center of electrical activities and industrial enterprises built up around this source of cheap power.



"What's the matter with your wife? She's all broken up lately."

"She got a terrible jar."

"What has happened?"

"Why, she was assisting at a rummage sale, took off her new hat and somebody sold it for 35 cents."

* * *

"I know he's a darling, but I'm afraid it's no use. My husband doesn't like dogs."

"You buy 'im, lydy. You can get another husband, but you won't git another dorg like 'im."

* * *

A writer at the Chicago convention declares that one colored delegate told him that he had been able to pay off the debt on his church since his arrival in the city. This reminds one of the old couplet:

I stole dem breeches but it wa'n't no sin,
I stole dem breeches to get baptize in.

* * *

A teacher was discussing the subject of political parties at school one day. When he had gotten through he asked:

"How many Republicans have we?" Some raised hands. Then he asked. "How many Democrats?" Some raised hands. Among those was Helen, who had just said she was Republican.

The teacher said: "Why, Helen, you cannot be both Republican and Democrat."

Helen said: "Yes, sir. My father is a Republican and my mother a Democrat."

* * *

Stella.—"Does she live from hand to mouth?"

Bella.—"No, from ear to mouth."

* * *

"Why did you give your parrot away? The poor bird meant nothing by its profanity."

"I could stand its profanity, but it was learning to imitate my neighbor's rusty lawnmower."

* * *

A Matter of Names.—"What is the difference between *pomme de terre* and potato?"

"About two dollars."

* * *

"Why are you so sore on that eminent millionaire? He has done some good things."

"I was one of them."

Sibyl.—"When Steve proposed to me he acted like a fish out of water."

Maud.—"Why shouldn't he? He knew he was caught."

* * *

"You're working very hard today, Jake, me son," said a friend to a bricklayer's laborer. "How many hods of mortar have ye carried up that ladder since startin' time?"

"Hush, me lad," said Jake, with a wink. "I'm foolin' the boss. I've carried the same hodful up and down all day, and he thinks I'm working!"

* * *

"Think I'll go to the ball game today."

"All right. Is there a telephone at the grounds?"

"There's one near there. Why?"

"If the home team loses I want you to telephone me, so that I can take the children and go over to mother's until you get your temper back."

* * *

The home of a negro kalsominer in Pittsburgh bears the following original, though much to the point sign:

"GOIN OUT WHITEWASHING DONE IN HERE."

* * *

Judge.—"Why didn't you stop beating him when he cried 'Enough'?"

Sambo.—"W'ye, ye see, sah, dat nigger is sich a liah, ye can't nevah beliebe 'im."

* * *

"How did he manage to escape from the penitentiary? I thought it was well-nigh impossible."

"Well, he figured it out on scientific lines. Somebody smuggled him a pair of trunks, and after he got outside everybody thought he was running a Marathon."

* * *

A keen student of human nature must have written the following:

"When you see a young man sailing down the street shortly after midnight with his collar crumpled, you can make up your mind that there's a young girl crawling upstairs not far distant, with her shoes under her arm and an extinguished lamp in her hand.

JOHN! I HEAR BURGLARS! GET UP! — THE MATCHES ARE ON THE DRESSER
ILL GET A MATCH AND LIGHT THE GAS.
1
JOHN! IF YOU SEE THE WHITE OF HIS EYE - SHOOT HIM!
BERTHY, I CANT FIND THE MATCHES
2
FEEL ON THE DRESSER I TOLD YOU
BERTHY- WHERE'S THEM MATCHES?
3
HELP! HELP! HELP
LOOK OUT! IT'S A WILD ANIMAL!
BANG!
BANG!
BANG!
BANG!
4
YOU HAVE SHOT MY NEW SWITCH-
HERE HE IS-DONT BE AFRAID-HE IS DEAD
THEN THEY MADE A — LIGHT
5
HELLO! IS THIS THE LANDLORD? IF YOU DONT PUT IN ELECTRIC LIGHTS AT ONCE I MOVE- SEE?- ALL THE TIME I'M GETTING IN TROUBLE OVER THEM BUM GAS LIGHTS
NEXT MORNING
6

Common Electrical Terms Defined

In this age of electricity everyone should be versed in its phraseology. By studying this page from month to month a working knowledge of the most commonly employed electrical terms may be obtained.

SHADOW PHOTOMETER.—A photometer for measuring the intensity of light cast by two sources of light by comparing the shadows of the same object cast by the two lights at the same time. (See cut.)

Shadow Photometer

SHELLAC. — A resin obtained by gathering the sap which comes out of punctures of the bark of certain Asiatic trees. Made into a solution with alcohol it is used as an electric insulator, being applied like a varnish.

SHORT CIRCUIT.—If two wires of opposite polarity are connected together with very low resistance or none at all between, a very heavy current according to Ohm's law, $C = \frac{E}{R}$, will flow, as R is practically zero.

SHUNT.—A branch circuit taken off the main circuit and returning to it farther on. Through this branch part of the current flows, the remainder flowing in the main circuit.

SHUNT WINDING.—A term applied to a dynamo or motor in which the two ends of the field windings are connected to the brushes or to the machine terminals. The field windings are then in shunt or parallel with the external circuit.

SILVER BATH.—An electro-plating solution for depositing silver. One formula is as follows: Water, ten parts; potassium cyanide, five parts; metallic silver, 2½ parts, all by weight.

SKIAGRAPH.—A shadow picture taken upon a photographic plate by means of the X-rays.

SKIN EFFECT.—Currents which change direction often are carried by the outer layers of the conductor. This greater density of alternating currents near the surface is called the skin effect.

SMASHING POINT.—After a carbon incandescent lamp has burned 500 or 600 hours its candlepower falls off from 15 to 20 per cent so that for the light given the current consumed is too much. For this type of lamp, therefore, it is a saving to "smash" it or in other words replace it at the end of its economical service.

SOLENOID.—A coil of wire of cylindrical shape in which the length of the cylinder is more than its diameter.

SOUNDER.—An instrument used in telegraphy. It consists of an electro-magnet and an armature attached to an oscillating bar and so adjusted by screws that a sound is produced, whenever the magnets are energized, by the bar striking a second adjusting screw. By means of it the dots and dashes of the telegraph code are received and read.

SPARK ARRESTER.—A wire screen fitting about the carbons of an arc lamp globe at the top to prevent hot pieces of carbon from escaping.

SPARK COIL.—A device consisting of a coil of wire wound about a core of soft iron wire and connected to a low voltage source. If such a coil is connected to a battery and the circuit closed and opened a spark depending upon the source of current and the size of the coil will be produced.

SPARK GAP.—The space between the knobs or points upon a static machine, coil or other electrical apparatus across which a spark is designed to pass.

SPARKING.—Used in referring to the sparks between the commutator segments and brushes of a dynamo or motor.

SPRING JACK.—A telephone switchboard device consisting of a cylindrical opening behind which are arranged one or more spring contacts. When a plug is inserted in the jack, contacts on the plug press against the springs in the jack, and thus a circuit is completed through the cord attached to the plug. (See cut.)

Spring Jack

STANDARD CANDLE.—See Candle, Standard.

STARTING BOX.—A term applied to the adjustable resistance, used in starting a motor, to control the current until the motor has developed enough counter e.m.f. to take the place of the resistance.

STATOR.—The stationary part of an induction motor. This portion carries the coils into which is sent the driving current.

STATIC BREEZE.—A continuous spark discharge from a static machine. A person receiving treatment with such a current is seated upon an insulated platform attached to one pole of the machine while a metallic crown connected to the other pole is suspended one or two feet above the head.

STATIC ELECTRICITY.—A rather indefinite term applied to electricity not in the form of steadily flowing current. The kind formed on an electrophorus, on a glass rod rubbed with a woolen cloth, or on a static machine.

STEP-DOWN.—Used in connection with a transformer to indicate that the alternating current supplied to it is lowered in voltage in passing through it.

STEP-UP.—The reverse of step-down. (See Step-down.)

STORAGE BATTERY.—A number of separate storage cells connected to form a single source of electric energy.

POPULAR ELECTRICITY MAGAZINE

In Plain English

HENRY WALTER YOUNG, Editor

Vol. V | October, 1912 | No. 6

CONTENTS

	Page
WATER FOR LOS ANGELES FROM BEYOND THE MOJAVE	513
DESTROYING THE VAMPIRES OF THE DEEP.	516
Alley Pole Lines	518
Prevention of Hail	519
Paddle Wheels Open and Close Bridge	519
Playing Tennis at Night	520
Lightning Bores Iron	520
Ouch!!!	521
Continental Types of Heaters	521
The Cable Splicer at Work	521
THE GREAT LAKES NAVAL TRAINING STATION	522
Great Causeway Across Galveston Bay	526
Wireless on Monoplane	526
New York's Double-deck, Stepless Car	527
Announcing Subway Stations	527
Tree Vibration for Saving Buds from Frost	528
Keeping Insects Out of Lamp Globes	528
Electricity in Place of Food	529
Telephone as Aid to Talking Machine Sales	529
RUBBER'S SECRET CONQUERED	530
Theater Ear Phones	533
Laying Lighting Cables in Japan	534
Ballbearings on Electric Cars	534
Roadside Telephones	535
Illuminated Music	535
A SHERLOCK OF THE SEAS	536
Self-starting Gasoline-electric Automobile	540
Aeroplane Roundabout	540
Radium Rays in Coloring Gems	541
How the Electric Won a Hat	542
Electrical Developments in Minneapolis	542
Woodpeckers Destroy Telegraph Poles	543
Ornamental Luminous Arc Lamps	543
CADILLAQUA—DETROIT'S BEAUTIFUL WATER FESTIVAL	544
Automatic Annunciators at the Water Carnival	546
Lighthouse Tended From the Shore	547
SOME SECRETS OF ELECTRICAL STAGE CRAFT	548
Engineering Education	552
Electric Shoveling Machine	
Tablet Commemorating First Telegraphic Train Order	558
One of the Pioneers	556
CHICAGO'S NEW POLICE PATROL BOAT No. 2.	557
Emergency Pumping Outfit	558
Shooting by Searchlight	558
X-ray in Observing Bone Structure	559
A 60,000 Egg Incubator	560
A Landmark That Turned a Trolley Line	562
Milking Cows in the Pasture	562
The Steno-phone	562
Men Wonder at New Audit Machine	564
Brain a Telephone Exchange	565
Electrical Scarecrow	565
Electric Current at Work	
Ampere Hour Meter for Electrics	566
A New Electric Fan Creation	566
Dental Engine Operated by Dry Cells	567
Lamp Socket Attachment	567
A New Insulator	567
Motor Driven Milking Machine	568
Wall Pull Switch	569
A Giant Drill	569
New Type Fan Guard	570
Tree Insulator	570
Daylight Egg Tester	570
Car Cleaning While on the Way	571
Magnetic Chuck	571
Illuminated Vest Buttons	572
Lighting Fixtures Part of Piano	572
Light for Memorandum Pad	572
Telephone Scratch Pad	572
ELECTRICAL MEN OF THE TIMES. Frank Morrison Tait	573
The Price of One Cigar	574
Electrical Interests of Women	
Sonnenberg	575
A Marshmallow Roast	576
Marketing by Telephone	576
Electric Milk Warmer	577
Do You Believe in Signs?	577
The Cut-Out Switch	578
Sterilization of Drinking Water by the Violet Ray	578
The Flexilyte Lamp	579
Electricity and the "New Attitude Toward Disease"	579
Roast Young Pig	581
Electric Comb for Drying Hair	582
Hints for Using the Toast Stove	582
Table Fan with Fern Dish	582
Junior Section	
An Interesting Trick with Static	583
Model Electrically Driven Shop	583
The Electrascore	584
Lead Pipe Storage Battery	585
Energy from Lines of Force	585
Rectifier	586
Dust Picture	586
Indian Boys Advertise Electricity	587
"Drop in a Good One, Please"	587
Popular Electricity Wireless Club	
FEDERAL WIRELESS STATION AT CENTRAL POINT, OREGON	588
Wireless on Zeppelin Airships	591
Alexander Wireless Bill	592
Electrolytic Interrupter	592
Questions and Answers in Wireless	594
Carnegie School's Wireless Station	595
Directory of Wireless Clubs	595
For Electrical Workers	
Electrical Wiring	597
Combination Lamp for Photography	601
Correction	601
Testing for Lamps "On"	601
Electric Bell Circuits and Their Installation	602
Fan Advertisement	609
Doing Business Between Bites	609
An Illuminated Key Sign	610
The Lolly Gymnast	610
Fashion Cabinet	610
Miscellaneous	
THE INVENTOR, WHO HE IS AND WHY	611
ELECTRICAL SECURITIES	615
New Books	617
New Sound Proof Telephone Booths	618
Telephone Service in Pekin	618
Famous Church Bells Electrically Tolled	618
Examining Coal with X-rays	618
Electric Ordering Device for Restaurants	619
Electric Steel Production in Norway	619
Death of Henri Poincare	619
Sir Hiram Maxim's Collision Preventor	619
Determining Longitude by Wireless	620
A New Road Over the Alps	620
Wireless in the South Seas	620
Explosion of Radium	620
United States First in Communication Facilities	621
What Horsepower Really Measures in Watts	621
A Giant That Knows No Mercy	621
Short Circuits	622
Common Electrical Terms Defined	624

RENEWALS When your subscription expires, you will find a renewal blank enclosed here. You should fill out and return with remittance at once to avoid missing a number. Positively no copies will be mailed on any subscription after same expires unless renewed, and we cannot agree to begin subscriptions with back numbers. The date on wrapper of your magazine shows issue with which your subscription ends. The extension on this date to period covered by renewal is sufficient receipt. If any other is desired it should be requested at time of renewal.

CHANGE OF ADDRESS Notify us promptly of any change in your address, giving both the old and new location. Since our mailing list for each issue closes the 5th of the preceding month (i. e., list for February closes January 5th), changes received after the 5th must necessarily take effect with issue for second month following. Postmaster as well as Publisher should always be notified of changes in order to forward mail sent to old address.

ISSUED MONTHLY BY POPULAR ELECTRICITY PUBLISHING CO., Commercial Bldg., Chicago, Ill.

YEARLY SUBSCRIPTION, $1.50; CANADIAN, $1.85; FOREIGN, $2.25; SINGLE COPY, 15 CENTS

No additional copies will be sent after expiration of subscription except upon renewal.

Entered as Second Class Matter April 14, 1908, at the Post Office at Chicago. Under Act of March 3, 1879.

Copyright 1912, by Popular Electricity Publishing Co.

Centrifugal Drill Being Tested at Silver Lake.

Jawbone Division Connecting Two Tunnels.

Building a Concrete Siphon.

52-Mule Team Hauling Steel Sections for the Saugus Siphon.

Some Interesting Views of the Work on the Great Aqueduct Which Is to Bring Water to Los Angeles, 250 Miles Across Mountain and Desert, Incidentally Developing 160,000 Electrical Horsepower

PUBLIC SERVICE
NEWARK, N. J.

Popular Electricity
In Plain English

VOL. V OCTOBER, 1912 No. 6

Los Angeles Water from beyond the Mohave

By C. L. Edholm

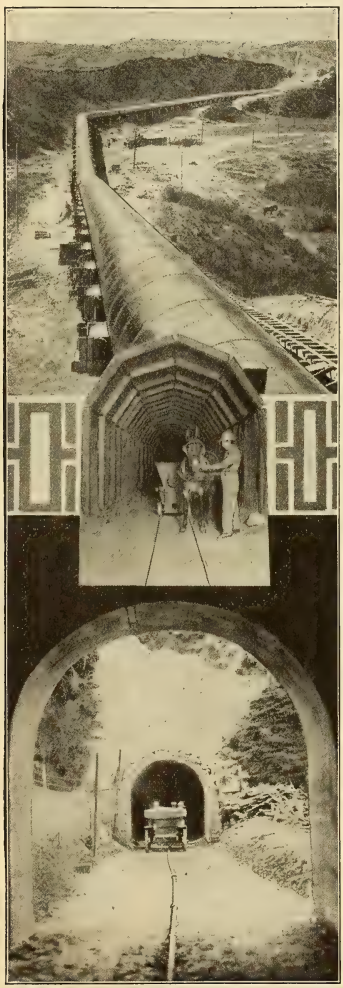
When the city of Los Angeles set out to bring water from the Sierras, a few years ago, running a series of ditches, tunnels and flumes across mountain and desert for almost 250 miles, the greatest emphasis was laid upon the fact that an enormous amount of pure water was to be brought to the city for domestic purposes and irrigation. A water famine had been threatened, owing to unusual drought, and the city was made to realize with terrible certainty that without a new source of supply there would be no future for Los Angeles.

Now, as the great work nears completion, the possibilities of the aqueduct as a generator of electric power are becoming more clearly defined, and the general public is beginning to realize that the development of the power system with a capacity of 160,000 horsepower will mean almost as much to the city as the delivery of 20,000 miner's inches of water for a thirsty land.

With the improvement of the Los Angeles harbor, now making rapid progress, and with the opening of the Panama Canal in 1915, commerce and industry should be immensely stimulated around the south Pacific Coast, and the delivery of a vast amount of power at a low cost will be a big factor in this development.

The aqueduct is said by experts to be second only to the Panama Canal as an engineering feat, and in describing it one deals with figures which stagger the imagination. Imagine the difficulties of bringing a fair sized river a distance of almost 250 miles, through mountainous regions and across the burning sands of the Mojave desert, building conduits and boring tunnels so large that big automobiles now run through them on the engineers' trips of inspection. Imagine this work being done in a sparsely settled or uninhabited section of the country, far from the railroad and other sources of supply and in a country so rugged that even the sure footed little burros, used in the preliminary work, found it hard to

secure a foothold on the rocky ledges. This was the situation which confronted the daring engineers who planned to bring a large part of the flow of the Owens River from 12,000 feet above sea level and deliver it at the door of Los Angeles, at a cost of $23,000,000.

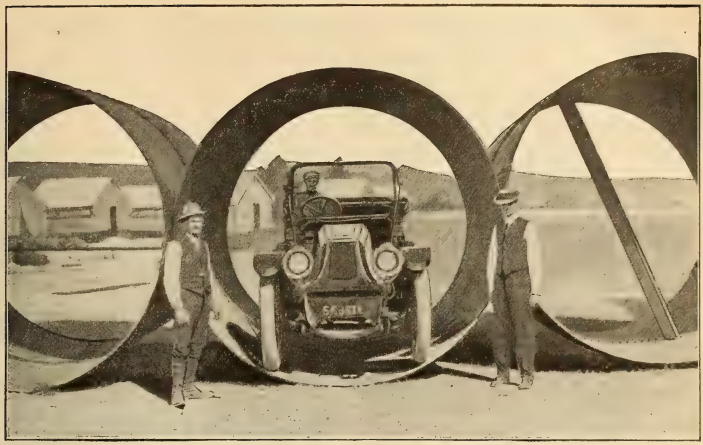


THE GREAT SOLEDAD SIPHON AND TUNNEL WORK INCIDENTAL TO ITS CONSTRUCTION

Today the great work is closing up the last links of the chain of conduits, tunnels and siphons, and early in the spring of 1913 we will see the aqueduct completed.

The first section of the aqueduct consists of an open trench 60 feet wide, which was dug by suction dredges that cut out the soft earth by means of huge jets of water, after the principle used in hydraulic mining. This canal carries the river around the Owens Lake and on to the Haiwee reservoir. Below this is a power drop, one of the series which will be linked up by the system. Then come miles and miles of rugged country, which was pierced by tunnels, having a total length of 32 miles, while crossing the canyons between the tunnel mouths are flumes of concrete and steel siphons, eleven feet in diameter. These gigantic steel pipes are said to be the largest in the world, and there will be nine and a half miles of them. They are built of massive plates having a thickness of from one quarter to 1⅛ inches, and are so large that a motor car can be driven into the tube and have plenty of room to spare. It requires a team of 52 mules to draw a single section of this gigantic pipe.

Most notable among the siphons are the Jawbone and Soledad pipes, each of which is about a mile and a half long, and they are carried across the valleys on heavy concrete piers. Then comes a drop into the Mojave desert, which is spanned by a trench lined with concrete and furnished with a stout cover of the same material reinforced with iron rods. The cover is to prevent cloudbursts and sand storms from polluting the mountain water and filling the trench with gravel.



STEEL SECTIONS FOR THE SOLEDAD SIPHON

Among these concrete siphons, which have been installed where it was not expedient to use the steel pipes, is the Whitney siphon, near Newhall, which has a length of 900 feet and a diameter of ten feet inside. This pipe drops 65 feet to the bottom of the canyon, rising to a point just a few feet lower on the opposite hillside, where it connects with another tunnel. This is said to be the largest concrete siphon in the world, and in fact there are a number of features of the aqueduct construction that are record breakers.

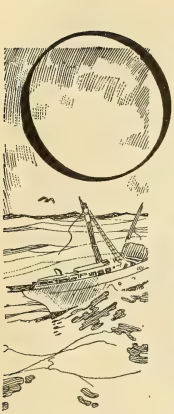
A report was filed this summer by E. F. Scattergood, chief engineer of the aqueduct bureau. It was in this report that the figures of 160,000 horsepower were first specified as the volume of energy to be produced from the aqueduct. Heretofore the accepted estimate had been 120,000 horsepower, and it was believed that expensive auxiliary steam generating plants would have to be installed by the city. Mr. Scattergood has been working on the engineering problems involved and has found a way to add 40,000 horsepower to the original estimate and also to eliminate the auxiliary plants.

At the present time the surveyors and right of way agents are working upon the course of a power transmission line to connect up the small plants already in operation at Division Creek, Cottonwood and Haiwee, all points far from the city, while others will be installed in Long Valley at Big Pine, in San Francisquito Canyon and at the San Fernando reservoir. Fifty foot steel towers, bearing the transmission lines, will link these various plants.

The advantage of this considerable number of power plants is obvious, as one or more might be shut down for repairs without putting the whole system out of commission, and in case of any necessity arising for stopping the flow of water in the aqueduct, the different reservoirs are of a capacity to supply power and water for several days. One of them, the Elizabeth Lake reservoir, above Power Plant No. 1, is large enough to receive the entire flow of the aqueduct for nine days.

Destroying the Vampires of the Deep

By EDWARD LYELL FOX

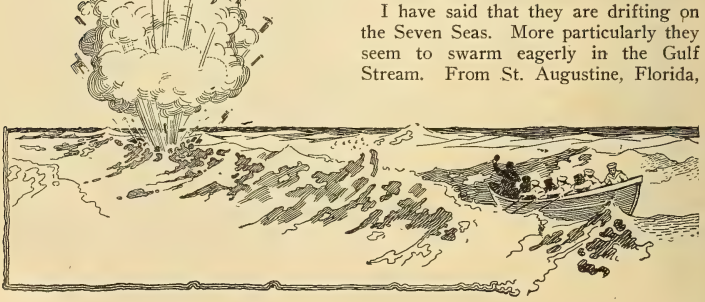


IN the wall of the Hydrographic Office there hangs a large chart of the North Atlantic. Across the pale blue space that represents water lie dark lines, the paths between our seaports and those of another world. Always these paths are the same—the same lines in the same positions. Were you to look at this chart another day, though, you would find that a number of dots clustered along the coast line had moved from one place to the other. On no day will you find the dots in the same position that they were the day before. For these dots indicate wrecks and derelicts—the vampires of the deep, ever changing, now lurking in the shadows of the coast, now drifting out to sea—deadly, sodden hulks whose mission is to take by surprise and destroy.

On the map they are placed as little silhouettes which are moved according to the reports sent in by wireless. Sea captains are ever on the watch for the peril, and upon sighting the dark hulks creeping along the surface of the water they are quick to flash the news to the hydrographic stations. And upon the receipt of this news, trim, fast moving cutters, whose commission it is to destroy all the derelicts, steam from the nearest port. By electricity, by the wireless bearing the news, their mission is made possible. And by electricity, the working of mines, their mission is fulfilled. For the derelict, you see, is blown through the water and into the air—a vampire that can no longer tear into the bodies of unsuspecting ocean craft.

Today there are about 2,000 derelicts in the waters of the world—floating perils that go where wind and currents bid them. Every sea is made hazardous by their presence. They have crashed into ocean liners, into junks of the China Sea. To them all vessels are alike—something to be destroyed. They crash against them in the dead of night, when inky blackness hides their coming. Wrecks themselves, they seem to strive to drag all others to their own fate.

I have said that they are drifting on the Seven Seas. More particularly they seem to swarm eagerly in the Gulf Stream. From St. Augustine, Florida,



they move north in its warm waters, silent, sullen travelers that creep through the waters unpleasantly, like eels.

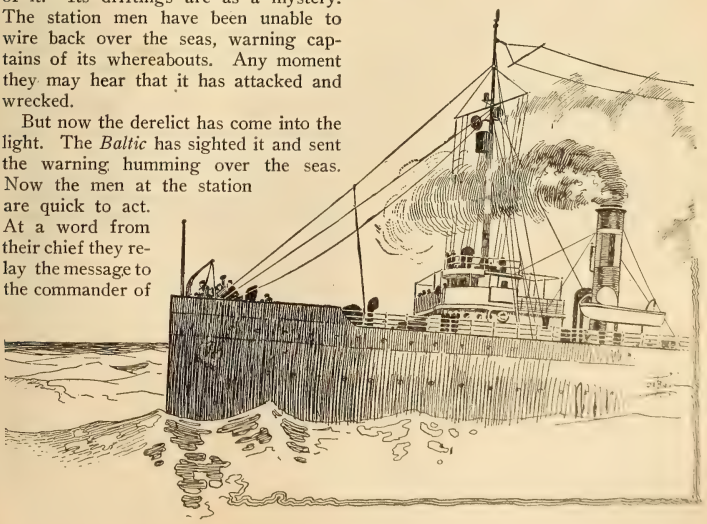
That is why there are so many dots swarming the Atlantic coast on the map in the Hydrographic Office. From Cape Hatteras reaching north to the Grand Banks of Newfoundland is the "graveyard of the Atlantic." It is a rolling waste where many ships are buried. It is a place where derelicts borne by the sweep of the Gulf Stream and the counter churn of the Labrador current dart about like angry sharks, eager to fasten their maws on the hull of some ship.

In the Hydrographic Office at some seaport the wireless is sounding. A message is coming through the void. It is a message of peril, coming from a steamship. It warns that a derelict has been sighted squarely in the path of ocean travel. For days the men at the station have been waiting for word of this derelict. Its position on the chart has not moved for a week. They have lost track of it. Its driftings are as a mystery. The station men have been unable to wire back over the seas, warning captains of its whereabouts. Any moment they may hear that it has attacked and wrecked.

But now the derelict has come into the light. The *Baltic* has sighted it and sent the warning humming over the seas. Now the men at the station are quick to act. At a word from their chief they relay the message to the commander of the revenue cutter *Seneca*, laying by. The *Seneca* has been waiting for this message —waiting for the derelict's whereabouts to be revealed. And now, knowing them, it gets up steam and sails forth—a purger of the seas, on destruction bent.

And as she is steaming toward the latitude and longitude given as the hiding place of the vampire, the *Seneca* keeps in wireless touch with the station. And now, while she is racing toward the wreck, let us see exactly what her quarry is. Then we may better picture the work of destruction.

Of derelicts there are two—the kind that floats observed and the kind that floats unobserved. Most people imagine that shipwrecks are ultimately driven ashore, and that vessels reported sinking at the time of abandonment go down soon after. That is not true. Abandoned ships breed vampires of the deep. For months they float. Water logged, half sunken, pitched and torn by storm, they yet somehow seem to survive. They will live in gales that send the staunchest



vessels to the bottom. Only Time can destroy them—that is, unless electricity takes a hand.

Too heavy to rise to the surface, and yet not water soaked enough to sink to the bottom and remain there, they crawl along just under the riding swells. Their abiding place is nowhere. From the untraveled tracks of the seas they may be carried by a storm directly in the path of navigation. Whither they go, no word goes before them. They descend unobserved, quietly, grimly. Not until they have struck is their presence known. Then they take their toll. They destroy a ship, and from it another of their kind is made. It is their way of multiplying and spreading the breed. That is why it is so important that they be destroyed.

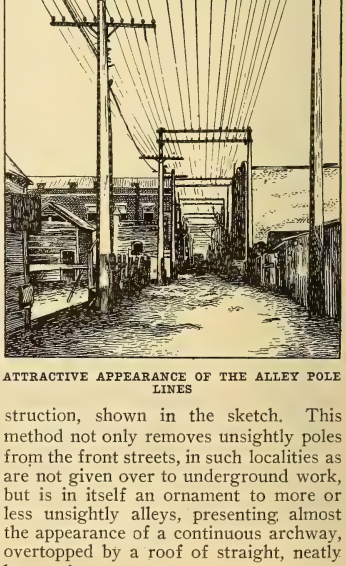
But now the *Seneca* has steamed into the province of the derelict. High in the mast the lookout is casting his eyes on all sides. If he is not alert, the derelict may attack those on board the *Seneca*. Self preservation is strong in a vampire.

But now the tip of a submerged mass rises above a distant swell. Caught in a sudden pitch of the sea, the derelict has revealed itself. From the lookout's nest the cry sounds. The speed of the *Seneca* is reduced. It moves slowly toward its quarry. And now the work of harnessing electricity for the destruction it must do begins. From the magazines are brought mines charged with 60 pound burdens of gun cotton. From the store houses are brought insulated electric cables and a hand magneto. A small boat is lowered and the mines are taken on board. Then the boat rides over the sea toward the derelict, a risky ride if the swells are running high.

And next comes the work of placing the mines where they will create greatest explosions. If the wreck is submerged, the task is more difficult. More mines must be used. Exquisite care must be employed in their placing. Finally the explosive charges are connected by means of the insulated electric cables, and the wrecking party draws off to a safe distance. The man with the hand magneto provides the necessary current. The detonators of fulminate of mercury explode. The primers of dry gun cotton are dealt a harsh blow. The explosion is sufficient to loosen all the heavy powers of the masses of wet gun cotton. And then the derelict flies apart, its back broken, its sides flying through the air—a scraping and rending of planks, the sodden splash as they hit the water again—the sound of a vampire dying.

Alley Pole Lines

The Oklahoma Gas and Electric Company is using concrete poles extensively on its Oklahoma City lines, and many of these are employed in a form of alley con-



ATTRACTIVE APPEARANCE OF THE ALLEY POLE LINES

struction, shown in the sketch. This method not only removes unsightly poles from the front streets, in such localities as are not given over to underground work, but is in itself an ornament to more or less unsightly alleys, presenting almost the appearance of a continuous archway, overtopped by a roof of straight, neatly hung wires.

Prevention of Hail

A new hail destroyer is about to be put to use in France on a large scale. The device is strangely like an immense lightning rod of absolutely pure copper, and it is grounded by a copper conductor. According to the theory of the inventors, these instruments, by their effect upon currents of atmospheric electricity, are well able to prevent the formation and fall of hailstones.

The Government of the French Republic, through a special commission of senators and deputies, is trying the invention in several places, and has inaugurated a campaign of education in rural districts upon the value of electrical conductors as preventives of the disastrous hail storms.

A chain of hail destroyers of the new kind is now being constructed in valuable vine-growing neighborhoods, which have heretofore suffered ravages from hail storms. The departments of the Gironde, the Beaujolais, the Loire Inferieure and the Charente are all notable sufferers.

Americans fail to grasp the terrible damage wrought by hail in France. Each year the losses exceed the approximate estimation of from $20,000,000 to $30,000,000. This is constantly increasing and will cause the experiments with the new hail destroyer to be extended and the system to be greatly improved.

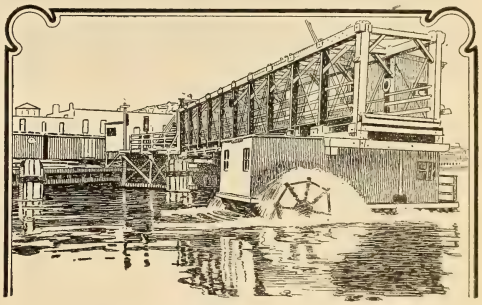
To determine the efficiency of the new invention with any degree of accuracy, it is realized that systematic tests over a long period will be necessary. To supervise this a committee has been formed from among the representatives of the French government.

The notion that electricity is largely concerned with the formation, crystallization and precipitation of hailstones was first promulgated by engineers of the French Academy. The copper "hailstone killer" is called technically a "paragrele." It has multiple points and is capable of withdrawing immense quantities of electrons from the clouds to the earth. Thus the hailstones are prevented from forming, and lightning is carried off at the same time.

Paddle Wheels Open and Close Bridge

Opening and closing a temporary bridge by floating one end of it around upon a big scow is a rather unusual way to handle such structures, but is successfully used in the Chicago River at Indiana Street while a new bridge is being built.

Supporting timbers run from the bridge down to the scow and about these is built a housing enclosing a five horsepower motor geared to a shaft upon the ends of which are two old type paddle wheels. The other end of the bridge turns on a big iron pin. The sound of rushing waters accompanies the swinging of the bridge as the paddle wheels push the scow back and forth. A small switchboard and controller are located in the bridge tender's house, which is at the street level.



BRIDGE BEING SWUNG BY PADDLE WHEELS

Playing Tennis at Night

Efforts to illuminate tennis courts, and play at night, are almost as old as the game itself. One of the first schemes tried was a strong light at each of the four corners of the court. This was a failure. There were too many shadows —the players were constantly becoming confused by the glare from lights and court, and the center of the court was darkest.

The next plan tried was hanging rows of arc lamps over the net and over the back lines. The lamps, of course, interfered with play, and the glare in the eyes was bad. The shadows made the ball difficult to see, and there was no diffusion of light.

Then the experts reasoned that by hanging two arc lamps over each back line, and one over each of the four service courts, success would crown their efforts. The result was another failure. The glare and the shadows were still present.

More recently another plan was tried. A long trough reflector was hung down each side of the court, and thickly studded with incandescent lamps. An improvement was noted, but results were still far from satisfactory. Diffusion was poor, and shadows were plentiful.

The peculiarly exacting conditions have apparently been met, however, by a system designed by the illuminating engineers of the Buckeye Electric Works. The lights are placed to the sides of the court, and so arranged that they brilliantly illuminate an area a few feet larger each way than the dimensions of the court itself, with a diminishing illumination extending fully 100 feet in each direction, thus preventing lost balls.

THE PECULIARLY EXACTING CONDITIONS OF TENNIS PLAYING AT NIGHT HAVE PRACTICALLY BEEN MET

Lightning Bores Iron

During a recent electrical storm at Massillon, O., an official of the Brown Lumber Company sitting in the office was startled by a loud report like the discharge of a gun and looking up at the ceiling noticed a blaze. Smothering this out he went on with his work but soon detected the odor of gas. On examination he discovered there was a hole large enough to insert his little finger in the iron gas pipe. The lightning had come in over the electric wires, jumped off onto the gas pipe which they crossed at right angles, bored through the iron and ignited the escaping gas.

Ouch!!!

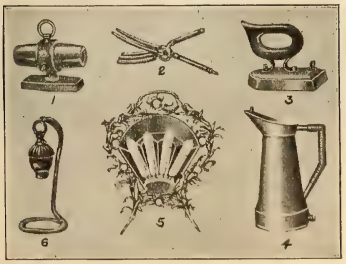
With the aid of a flashlight incased in the policeman's club, escape is impossible from a blow even in the dark, as the upward swing shows the "copper" the place to land on.

AN ELECTRICAL HINT FOR POLICEMEN

The inventor, Robert L. Litsey, of Seattle, Wash., probably was missed once and thought of the needed improvement.

Continental Types of Heaters

Electric cooking and heating utensils are now so common that we are all familiar with the usual designs followed by our manufacturers. Similar utensils turned out by German or French manufacturers, however, often have an altogether different appearance, in some cases so different that at first sight we scarcely recognize what they are intended for. The accompanying illustration shows some Continental designs. The curling iron heater, for instance, looks like a toy cannon, while the curling iron has the appearance of a carving set.



(1) CURLING IRON HEATER. (2) CURLING IRON. (3) FLATIRON. (4) WATER HEATER. (5) RADIATOR. (6) CIGAR LIGHTER

The Cable Splicer at Work

In this picture we are looking down into a manhole in which are several telephone cables. A "splicer" is at work

CABLE SPLICER AT WORK

connecting the wires from an incoming cable to those of an outgoing one. Instead of wiping with lead the casing of each bundle of insulated spliced wires, the Bierce cable sleeve, a metal cylinder either solid or in halves, is slipped over the splice. No solder is used, the sleeve

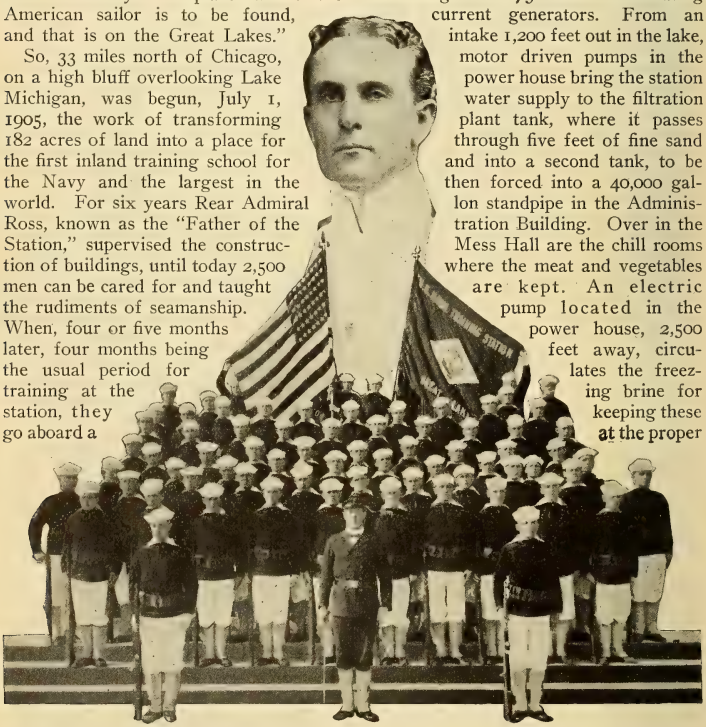
BIERCE CABLE SLEEVE

being made water tight by a rubber cone crowded about the cable at each end of the sleeve.

The Great Lakes Naval Training Station

"We must look to the Great Lakes for our sailors of the future" was the decision of the naval authorities after the war with Spain. "The American seacoast sailor is a thing of the past. There is only one place where the American sailor is to be found, and that is on the Great Lakes."

So, 33 miles north of Chicago, on a high bluff overlooking Lake Michigan, was begun, July 1, 1905, the work of transforming 182 acres of land into a place for the first inland training school for the Navy and the largest in the world. For six years Rear Admiral Ross, known as the "Father of the Station," supervised the construction of buildings, until today 2,500 men can be cared for and taught the rudiments of seamanship. When, four or five months later, four months being the usual period for training at the station, they go aboard a man-of-war, details of drill and discipline are already established and the recruit is ready to give his attention to handling the machinery of a battleship, no small part of which is electrically controlled.



CAPTAIN O. F. FULLAM, COMMANDANT U. S. NAVAL TRAINING STATION, GREAT LAKES, AND ONE OF THE CRACK SQUADS

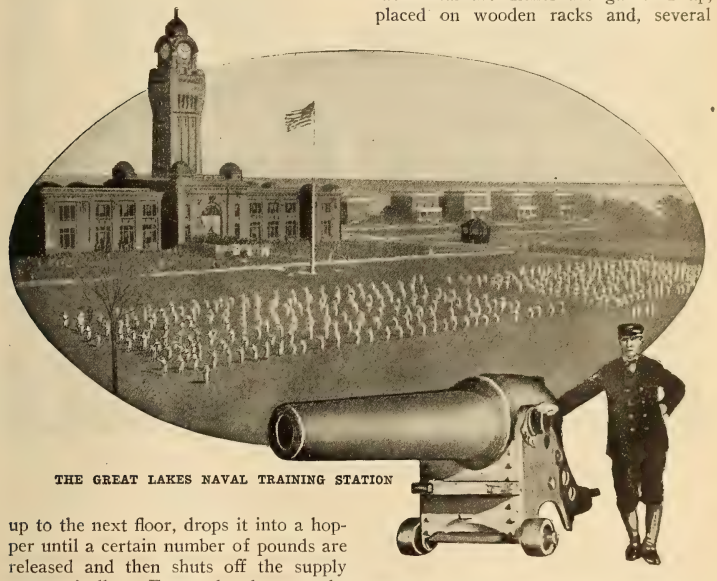
In building the station, provision was made to use electricity wherever possible, from lighting the buildings to preparing the food. At the foot of the bluff, just at the water's edge, is the power house, containing three 175 kilowatt alternating current generators. From an intake 1,200 feet out in the lake, motor driven pumps in the power house bring the station water supply to the filtration plant tank, where it passes through five feet of fine sand and into a second tank, to be then forced into a 40,000 gallon standpipe in the Administration Building. Over in the Mess Hall are the chill rooms where the meat and vegetables are kept. An electric pump located in the power house, 2,500 feet away, circulates the freezing brine for keeping these at the proper temperature at all seasons of the year.

Sanitary handling and preparation of the food for a big body of men is absolutely necessary, as is also its rapid handling in large quantities. The Mess

Hall where the men are fed illustrates this feature and electricity does much of the work. A flour blender takes several grades of flour according to the desire of the baker, mixes them, sends the blend up to the next floor, drops it into a hopper until a certain number of pounds are released and then shuts off the supply automatically. From the hopper the flour drops into the dough mixer, a little later to come out in the form of loaves ready for the oven. And this is all done by electric power, from 1,600 to 3,000 loaves a day being prepared in one-half the time required to perform the same work by hand.

Then there is the egg beater which holds close to a bushel of eggs free from the shell and the ice-cream freezer with an attachment in the way of an ice crusher. A rather large "detail" would be required to peel the potatoes used at the station but a "spud" peeler does this at the throw of a switch, and a half dozen apprentices remove here and there a black spot as the "spuds" come from the peeler.

In the "galley" (kitchen) a meat chopper cuts up the meat in quantities ranging from 1,000 to 4,000 pounds a day according to the bill of fare, and after each meal the dishes are gathered up, placed on wooden racks and, several racks at a time, washed by a motor operated washer.

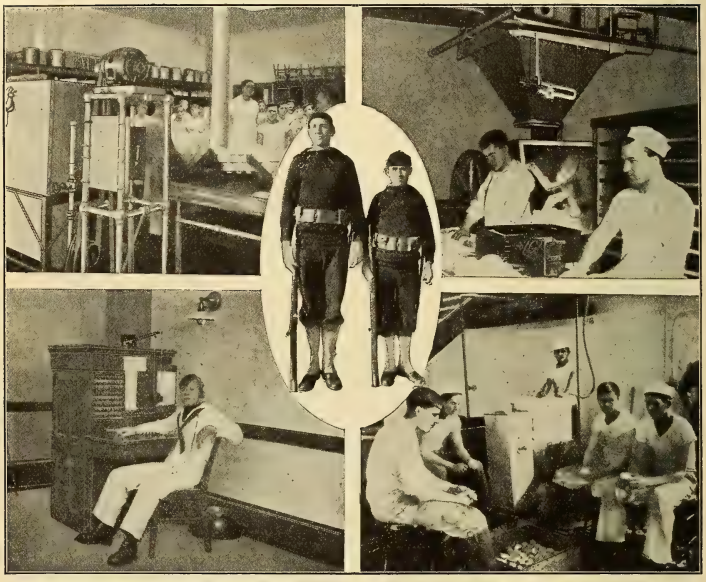


THE GREAT LAKES NAVAL TRAINING STATION

While electric current helps to feed the young "jackies" it also contributes to their recreation. The station has a large auditorium equipped with a stage, curtain and a moving picture machine where regular entertainments are given each week, some of the talent being such as play the best theaters in large cities.

Now, just a word as to the station and the life of Uncle Sam's future men o' warsmen.

At the entrance of the grounds a seaman's guard (a recruit who has already seen service on the water), rifle in hand, invites you to "come aboard"; for all



ELECTRIC DISH WASHER
ONE OF THE BRIGADE BOYS DETAILED AS "HELLO GIRL"

ELECTRIC DOUGH MIXER
PUTTING THE FINISHING TOUCHES ON POTATOES AFTER THEY HAVE PASSED THROUGH THE ELECTRIC PEELER

MUTT AND JEFF—TWO CHUMS

conversation, orders, etc., take on a nautical turn the moment the station's boundaries are crossed and the recruit must think and act accordingly.

The recruits are young fellows with a longing to see the world and to experience the life in the Navy. An average young man from the farm, the small town, or the city—just an average boy of seventeen or eighteen, careless, perhaps in his dress, his walk and his grooming—comes into the receiving room and reappears from another door a little later, an embryo man o' warsman in the white duck uniform of the service. It is quite possible that his own mother would not know him. He has gone direct from the receiving room to the dressing room, where he takes off his citizen's clothes for which he has no further use; to the barber, where he is shaved and his hair cut; he takes a bath and then goes to the doctor. The medical examination is for the purpose of discovering any defects which the recruiting officer may have overlooked and for the purpose of identification. The Government gives him a $75 outfit of clothing and he packs up his old clothes and sends them home.

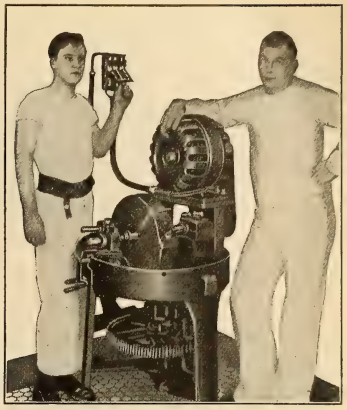
For 21 days the new recruits stay at the reception barracks, and during this time and while at the station they wear leggings to distinguish them as apprentice seamen. They are quartered in dormitories, of which there are six. The walls are hung with code signals of the Navy, so wherever the youngster looks, he is reminded of the life he has chosen.

Although they are not permitted to eat or sleep together during the 21 days in the reception barracks, there are no restrictions in regard to their out-of-door sports. They play ball as well as drill together on the parade ground. There is no danger of contagion, it is claimed by naval authorities, out of doors. Whatever of military discipline exists is not obvious. As long as the recruit conducts himself like a gentleman, he knows nothing of any such discipline. There are no sentries and the gates stand open.

The first consideration of the training school is to make its apprentice seamen physically and morally clean.

At the end of the 22 days, when all danger of any contagious disease is over, the recruit is sent to the main barracks and his work and instruction begin. He is taught the care of clothing, blankets, equipment and personal belongings. He is given a thorough course in hygienics, and is taught to swim. As soon as he knows how to care for himself, he is ready for the drill hall. The walls of the drill hall are covered with representations of flags of all nations and the signal codes. A huge compass is painted on the wall in exact representation of the compass on board a man o' war, that he may learn to box the compass, and there is a "log" and a "lead line" where he can learn the "marks" and "deeps." He is taught how to make knots, to splice ropes, to make hitches and bowlines, to coil down gear, and in the summer time he is taught how to handle boats both under sail and under oars.

After being assigned to a battalion, other drills are begun and the apprentice seaman is continued in the instruction of the semaphore (signaling with arms), is given the wig-wag (signaling with flag) and is taught the use of lights, rockets, and other night signals. He is given a rifle and is taught how to handle it. He is taught the manual of arms and target practice under warrant officers and petty officers. Many of the drill movements are timed to music.



ELECTRIC MEAT CHOPPING MACHINE

The apprentice seaman must "lash up his hammock" at 5:00 a. m. and fifteen minutes later has his appetite whetted for breakfast by a cup of cocoa. Cleaning up about quarters until 6:45 is followed by bathing formation when under an immense shower bath of 80 nozzles, enough to soak a whole company (80) at one time, the men are tuned up for the day. At 7:30, breakfast. During the morning there are drills to be attended, "grinders" as the boys call them. These are not held on liberty days, (Saturday and Sunday). At 12:00 noon, squads from the various barracks march into the Mess Hall for dinner.

Realizing that no physical strength is achieved on a diet of inferior food, the Government provides for its apprentice seamen the best in the market. They have beef, pork, stews, all vegetables and fruits in season, pork and beans, and cake.

On Wednesday from 3:30 to 4:30 p. m. exhibition drill takes place on the parade grounds. Supper is served at 6:00 each day and at sundown the gates of the station are closed. Tattoo sounds at 9:00 and the "jackies" swing into their hammocks to listen to "taps" at 9:05.

Great Causeway Across Galveston Bay

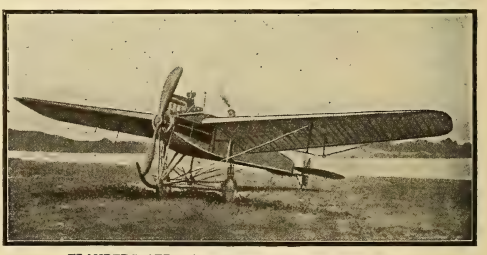
Three years ago, in September, 1909, work was begun on the great concrete causeway across the bay at Galveston, Tex. It was completed only about three months ago. It is being used by the Galveston-Houston interurban electric railway and several steam roads as well as public vehicles.

The cost of this undertaking was over $2,000,000. The total length, including unprotected roadway, is 10,642 feet, approximately two miles. The portion shown in front in the picture is the arch bridge, 66 feet wide, with 28 arches of 70 foot span. There is also a rolling lift bridge 52 feet six inches wide.

Wireless on Monoplane

Experiments with a Marconi wireless outfit on a Flanders aeroplane are being made at the Brooklands aviation grounds, England. It is now possible to use an aerial wire contained on the machine itself, instead of a hanging wire, as formerly, and this gives the pilot the advantage of flying nearer to other machines, and obviates any trouble which might arise from a hanging wire where the landing is made in a confined space. The new Marconi aeroplane set can be put upon almost any type of aeroplane. The set has been made up into several separately containing parts, with the idea of giving a good distribution of weight on an aeroplane. The apparatus is strongly constructed and has stood hard treatment. Primary cells or storage batteries can be used, and in the latter case a special non-spilling battery is supplied, so that there is no fear of acid splashing out and damaging the aeroplane.

It has been found convenient that the bulk of the apparatus be stowed under the pilot and passenger seats, so that it is designed with a view of placing it upside down or in any other position. The only part of the apparatus which need be exposed is the sending key and the small control switch. Beyond its uses from a military point of view, a machine thus equipped enables the pilot



FLANDERS AEROPLANE USED IN WIRELESS TESTS

to keep in connection with the aerodrome or headquarters during a flight, which in cross country or long distance flights would be of great importance.

New York's Double-Deck Stepless Car

The stepless car—introduced for the comfort of hobble skirt wearers—has now been followed by the double-decker. It has greater seating capacity, accessibility and more speed. On entering, passengers will have to mount a step of only ten inches and will face a conductor seated at a desk. An arching roof with a central height of seven feet two inches gives plenty of head room. Access to the upper deck is obtained by a central stairway where back to back benches run the length of the car over the arch of the lower story.

Economy of space makes the new double deck car only seventeen inches higher than the present standard of cars. The new car will seat 88 passengers and accommodate 171, as compared with 60 seated in the long and 50 in the short open cars, 51 in the stepless cars, 41 to 47 in the pay-as-you-enter type and 36 and 28 in long and short closed cars.

The equipment of this street car de luxe will include an electrical street announcer and an automatic cash register. There will be automatic control of ventilation and brakes. The car has an all-year-round smoking compartment, and can easily be converted into an open car in summer.

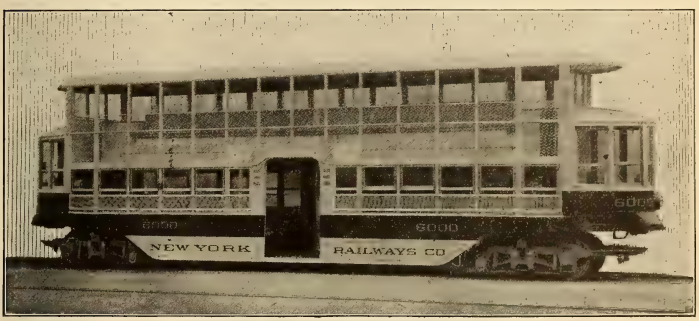
Announcing Subway Trains

A recent innovation in the New York subway consists of an electric train announcer for the convenience of passengers. Those who use the subway may have noticed three or four box like contrivances suspended over each side of the platforms on the northbound express stations.

Near the northern or uptown end of the platform sits a uniformed employe of the Interborough Rapid Transit Company. In front of him in two oak cases situated within easy reach of his hand are mounted seven push switches, four for local trains and three for express trains. Curious passengers gather around to watch this switchman at his work. A train comes roaring into the station. A quick glance at the headlights and a button is pushed.

Instantly in each of the boxes appears the legend:

BROADWAY EXPRESS
VAN COURTLAND PARK



A DOUBLE-DECK STEPLESS STREET CAR

or if it be a Lenox Avenue train the sign will flash out that fact in plain view of all the passengers.

As the train pulls out the lower button is pushed and the sign lights go out. These signs are somewhat unique, as while the current is off no words or letters are visible. This is owing to the use of a stencil arrangement covered with colored glass.

Tree Vibration for Saving Buds From Frost

A recent invention relates to a new system of motor operated tree vibration for saving buds and blossoms from frost.

A TREE VIBRATOR IN PLACE

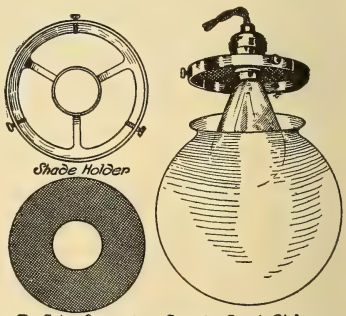
The new system aims to create in fruit trees a movement of the sap to the buds and blossoms that tends to vitalize them enough to resist the attacking blight of frost. This movement of the sap might be called a capillary action, and can be likened to the gentle exercising action of an electric vibrator instrument on the human system, which stimulates the flowing action of blood through the veins, especially at the point where the vibrator is applied.

The system for imparting this vibratory action to buds and blossoms has been worked out and patented by Herman L. Darling of Delta, Colorado. It comprises the installation in the tree of a small electric motor having a trembling rotary motion and connected by transmitting wires to an electric current.

During the months of April and May when the orchard is subjected to sudden freezes, by means of this system, a vibratory trembling motion is imparted to all limbs of the tree, transmitted to twigs and buds and this motion starts the sap to circulating, invigorates the buds and strengthens them against the killing effects of the frost.

Keeping Insects Out of Lamp Globes

To keep insects from the inside of light globes on porches and in other out-of-door places, I have found the following



LAMP GLOBE WITH INSECT SCREEN

useful: Take a piece of fine wire screen (wire gauze being preferable as it will keep out smaller insects) and cut it to fit inside the shadeholder. Then cut a hole in the center, fitting closely around the lamp socket. With the screen in place both the outer and inner globe will require less cleaning, as the screen will keep out a part of the dust as well as insects.

L. W. JAKES.

Electricity in Place of Food

At some future day, instead of taking food we will simply take electric current which will answer the same purpose, according to the somewhat startling announcement made by Prof. Bergonié at the Science Congress at Bordeaux. According to the French physician, the ancient habit of eating may one day disappear, and meals will be replaced by a sojourn of a few minutes in the electric cage which gives high frequency waves. It is known that this sets up currents within the human body so as to cause an internal heating, without, however, doing any harm. Now this heat represents a certain amount of energy, so that it is clear that we do not need to absorb as much food as before. When the body lacks food, it is seen that some of the organs become cooler owing to a loss of energy. The electric current acts to restore energy to the organs by heating them to a certain extent. At present, even if we cannot make the current replace food, at least it may be made to aid in nutrition and economize the work of the stomach, so that less food is needed.—*Le Matin (Daily), Paris.*

TELEPHONE AS AID TO TALKING MACHINE SALES

Some dealers in graphophones and phonographs are now employing the telephone in a novel manner. They use it for the purpose of playing a record to a customer who is unable to come to the salesroom to hear it. The accompanying illustration shows how the trick is done. It is stated many sales of records are accomplished by means of this method of demonstration.

Courtesy of the Inland Store Keeper

PHONOGRAPH BEING PLAYED INTO THE TELEPHONE TO INTEREST CUSTOMERS AT THE OTHER END OF THE LINE

Rubber's Secret Conquered

By E. LESLIE GILLIAMS

Occasionally one has a stroke of luck. Such was the accidental chemical discovery of synthetic rubber, in the making of which electricity will play a part.

It is claimed that synthetic rubber will shortly be placed upon equal terms of competition with the juice of the trees and the plants which have so long supplied the rubber of commerce. The demand for rubber, largely on account of its extensive use in the automobile and electrical industries, is increasing immensely, and the artificial rubber will come into the field none too soon.

In 1910 and 1911 the world's production of india rubber reached a total of about 80,000 tons and the world's consumption of this article was in the neighborhood of 75,000 tons. Figuring the cost of this rubber at an average of $1.00 a pound, the total value of the production reaches $160,000,000.

Now it is claimed that synthetic rubber, in every particular equal to the finest natural rubber, offers a possibility of a profit at a price of 60 cents per pound, with a probability of its production at 24 cents per pound or less. The only question is, can it be produced in sufficient quantities to be of commercial value? The claim is made by both English and German chemists that it can, and by the use of electricity, in hastening the process, this claim will likely be made good.

At the present time English and German chemists are disputing over their claims of precedence in finding a way to create from certain raw materials a chemical counterpart of natural rubber.

While this dispute is interesting as showing how great discoveries which have defied investigators for years are frequently finally made almost simultaneously in different parts of the world, the people at large are not greatly concerned in the determining of this question of priority, but they have a very deep interest in the commercial practicability of these discoveries.

The story of how they came about is one of the most interesting that has occurred in many years in the field of chemical investigation. Two years ago Dr. F. E. Matthews, a well known chemist of England, then associated with other distinguished chemists, among them Prof. W. H. Perkin, Sir William Ramsey and the Professor Fernbach of the Pasteur Institute, was seeking a perfect and cheap process for the manufacture of synthetic rubber. It occurred to Dr. Matthews that it would be interesting to study the action of sodium upon isoprene, and he therefore sealed up some isoprene with sodium and set it aside in July 1910.

In the month of August, during a holiday he was reluctantly compelled to return to London, and discovered that the contents of the tube had become viscid and contained a proportion of a remarkably good variety of rubber.

The tube was again set inside, and on examination in September was found to contain a solid mass of amber colored rubber. Dr. Matthews was amazed when he contemplated it.

Isoprene, the basis of synthetic rubber, is an oily, volatile hydro-carbon. Its discovery is not of recent event; as long as 50 years ago it was distilled by a chemist named Williams from caoutchouc. The analysis of isoprene showed that it was chemically identical with the oil of turpentine. Since the period of its discovery, it has presented a two-fold problem. First, how to derive isoprene from abundant raw materials, and then to effect its conversion into rubber through the medium of plentiful and cheap agents.

As has been realized from the beginning of the experiment in relation to synthetic rubber, to compete with Nature's product it is necessary that this made rubber should be manufactured in large quantities and at a cost which would put it on a par at least with the expense of gathering and delivering at the factories Nature's rubber.

Professor Fernbach, working on this problem and keeping in mind the fact that fermentation is an action set up by various kinds of germs, finally discovered the germ which, when stimulated by electrical action, would convert certain plentiful starchy materials into fusel oil, and from this product he obtained cheap isoprene. It was with some of Professor Fernbach's electrically produced isoprene that Dr. Matthews learned by accident how to turn isoprene and sodium into rubber.

The great importance of Dr. Matthews' discovery is that the action is practically quantitative and not seriously affected by the presence of impurities. It may also be carried out in the cold, or with the application of very moderate electrical heat. On the other hand, all the other processes for synthetic rubber which have been proposed are either excessively slow or involve a high temperature or the addition of reagents which affect the yield and quality of the rubber.

Further, a high temperature always produces a portion of terpenes, and has also, it is claimed, a deleterious effect on any rubber which may be formed. In addition, the presence of some impurities adversely affects the yield or greatly delays the process of manufacture, a fact which perhaps accounts for the varying success of previous workers in this field.

The discovery of the process above outlined of making synthetic rubber was brought about by the association of a group of the most distinguished English chemists working together, their work being conducted largely on the principle of a committee, and of this committee Prof. W. H. Perkin acted, it might be said, as chairman and in a suggestive and critical capacity.

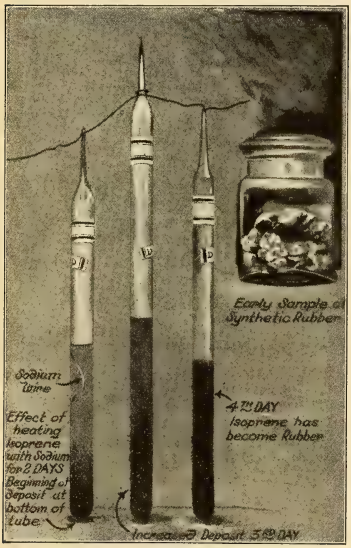
With the exception, therefore, of Dr. Matthews' valuable discovery, and the remarkable experiments on starch fermentation by electricity, carried out by Professor Fernbach, whatever credit there may be attached to the work accomplished must be considered as belonging to the whole group. The names of

PROF. W. H. PERKIN, LEADER OF THE COMMITTEE OF DISTINGUISHED SCIENTISTS WHO DISCOVERED SYNTHETIC RUBBER

the chemists and bacteriologists who have been engaged in this work are Henry J. W. Bliss, M. A., Harold Davis, Harry M. Elger, M. A., Prof. A. Fernbach, Thomas Kane, Francis E. Matthews, Ph. D., Prof. W. H. Perkin, F. R. S., Charles A. Pinn, Rupert W. Pope, Sir William Ramsey, F. R. S., Paul Schwen, E. Halford Strange, Charles Werzmann and Evelyn C. B. Wilbraham.

When the scientific standing of these workers is considered, there can be no doubt of their claim that the synthetic product that they have made is really rubber and strictly comparable with natural rubbers.

The Germans, however, have not yet acknowledged the claim of priority but, on the contrary, have come forward with a counter claim that they have a method for making synthetic rubber, in which electricity also plays a part, which will soon be ready to compete with the output of the tropical forest. It is a fact that



Courtesy London Illustrated News

TUBES SHOWING POLYMERIZED ISOPRENE AND SODIUM WIRE. ISOPRENE IS A MOBILE LIQUID, A "FAMILY" RELATIVE OF RUBBER; IT BECOMES SYNTHETIC RUBBER BY STANDING IN CONTACT WITH SODIUM WIRE THREE OR FOUR DAYS

they have been working on this subject for some time. In one factory alone in Germany there were 300 college bred chemists concentrating upon this discovery, and many other factories in the Fatherland joined in this international effort to find an artificial process by which rubber could be built up synthetically from raw materials readily available. But to the Elberfelder Farbenfabriken belongs the distinction of priority in the solution of the problem, so far as Germany is concerned.

Dr. Fritz Hofmann, director in charge at Elberfeld, speaking recently on the subject, had this to say regarding the pursuit of his colleagues and himself of the secret of synthetic rubber.

"By mere chance," remarked Dr. Hofmann, "my attention was called to the question of synthetic rubber through a lecture delivered in London about six years ago by Professor Dunstan. The problem fascinated me and I found on reading up the subject that caoutchouc was based on isoprene, and what was more, I had to have synthetic isoprene and not the kind obtained by a dry distillation of rubber such as had hitherto been used.

"Moreover, it was necessary to have an abundance of the material if useful experiments were to be conducted. Thus, at the start it was apparent that a process must be discovered by which isoprene could be obtained readily and reasonably in large quantities. Besides this, isoprene of the purest quality alone would suffice in order that no mistake should be made as to the nature of the results.

"I had a task before me. There were at least 50 different methods that promised to yield isoprene, but upon a trial most of them were at fault somewhere. After two years of hard work, we reached a clearing in the woods, although there were times during that period when we were on the point of giving up in despair, and would have done so probably, if the achievement had not become a matter of honor.

"To the organic chemist coal is an ideal mother substance, and I chose it as my basic material, and in this I was justified. In March, 1909, Carl Coutelle and myself succeeded, by an electrical treatment of coal, in obtaining the first large quantity of pure synthetic isoprene—several liters. This showed us that we had the right formulae, but with the making of isoprene, we were only at the beginning of our investigations.

"We were confronted next with the problem of converting this liquid into a tough, elastic, plastic colloid which was to be a successful substitute for rubber. Theoretically the task was easy, as we had several formulae on which to proceed. One was that by Bielstein, who had written that 'isoprene is converted to caoutchouc by treating it with muriatic acid.' Of course, we tried that at once, but for our pains we got nothing.

"Walach, another chemist, had written 'that the action of light would transform isoprene into a rubber like substance,' so we began again. After being exposed to light for a year and a half the contents of our test bottle had the consistency of a thin syrup.

"Next we tried all sorts of likely and imaginable physical and chemical mediums in connection with isoprene, but the wilful stuff refused to thicken. Finally, I discovered the power to perform this miracle hidden away in electrical heat. We soon recognized that the polymerizing power of this heat could be furthered by numerous chemical mixtures, but we soon found that there are many more substances that work in opposition to this end.

"In August of 1909 I attained the first rubber polymerized by electrical heat in the laboratory of the Elberfeld works. In September of that year I submitted a sample of this material to Dr. Gerlach, director of the Continental Caoutchouc and Gutta Percha Company of Hanover. He was the first to confirm that our product actually contained rubber. A month later Harris tested our synthetical material with his ozone method and by this means was able to establish that our electrical heat polymerized isoprene was veritable india rubber."

Which of the two processes, the German or the English, is the most practical for commercial purposes remains to be seen after careful experiments. At any rate, it is certain that the low cost of manufacture will be brought about by the valuable by-product, such as acetone.

Theater Earphones

There are 900,000 or more deaf people in London, according to the *London Daily Mirror*. These will shortly be enabled to hear perfectly all the plays produced at the many London theaters. An invention somewhat similar to a telephone has been perfected by Mr. G. R. A. Hope, and the New Theater already has several instruments installed. In a month every seat in the theater will be equipped with a little box similar to those from which opera glasses are obtained, and by placing a sixpence in the slot, an "earphone," as the new invention is called, is released for the use of the seat holder. All but the stone deaf will be able to hear.

THE THEATER EARPHONE

When the user cannot hear what the actor is saying, all that is necessary to do is to place the receiver to the ear and move the little indicator around until the required strength of voice is obtained. In a test of the invention, a whisper 20 yards away could be plainly heard. The invention, explains Mr. Hope, is a delicate telephone, built not to increase the loudness of the sound so much as to make it clearer.

Laying Lighting Cables in Japan

That electric light companies in Japan are very up to date in their construction methods is indicated in the picture, which shows a piece of underground conduit work being carried out by the native workmen of the Kobe Electric Light Company. A German firm supplied the cable and junction boxes.

LAYING UNDERGROUND CABLES IN JAPAN

Iron tape armored, asphalted lead cable with paper insulation and three sector shaped, stranded copper conductors is being used, capable of transmitting current at a pressure of 11,000 volts; it serves to connect the central station up to two substations, on the opposite side of a river. The cable ducts are at this point just dipping down to the tunnel under the stream.

Before starting to charge a vehicle battery ascertain from the vehicle or battery manufacturers the capacity of the battery in kilowatt hours; that is, the number of kilowatt hours that must be put into the battery to obtain from the vehicle its rated mileage on one charge.

Ball Bearings on Electric Cars

Ball bearings were for a long time held in small esteem by the mechanical world and were regarded as chiefly useful for bicycles, sewing machines and lawn mowers. The average man of to-day, and even many engineers, would be surprised to learn that ball bearings are now successfully used in some of the heaviest classes of machinery, as in the main journals of trolley cars, for example, and in large electrical generators.

An interurban car with ball bearings has been running regularly for 3½ years on the Atlantic City and Shore Railway, making in that time about 150,000 miles. This car is equipped with 32 ball bearings, there being four bearings on each axle. The thrust is taken by the two inner bearings of each set, the outer races of the other bearings being free to move endwise in order to avoid cramping.

It is said that these bearings have been packed with grease only four times during their term of service, and have had no other attention. Recently one pair of bearings was taken out and sent for ex-

amination to George M. Bond, of Hartford, Conn., one of the world's famous experts on refined measurements. In the test of one bearing, the mean, or average radial freedom was found to be 0.000046 inch—practically nil—and the mean end play 0.00125 inch. The mean or average eccentricity of inner race was found to be only 0.00004 inch, also practically nil.

In the test of the other bearing, the mean radial freedom was found to be 0.0003 inch, the mean or average end play 0.0097 inch, and the mean or average eccentricity of inner race 0.00025 inch. It is stated by Mr. Bond that the averages above given are those of readings for each, taken at each 45 degrees division of the circle; the maximum and minimum readings in all cases being so nearly alike, practically, that the resulting averages fairly represent the condition of these bearings at the time of the test.

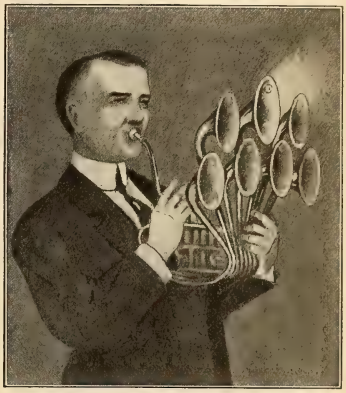
Roadside Telephones

The English automobilist makes certain that he will not be caught without some means of calling for help should his car break down upon the road. The Automobile Association has had erected along the main traveled highways "sentry boxes," as they are called, in which telephones are installed. In case of breakdown, the motorists are thus enabled to telephone to the nearest repairer for assistance and to communicate with their homes and offices.

ROADSIDE TELEPHONES IN ENGLAND

Illuminated Music

A clever musician in vaudeville entraps both the eye and the ear by having a small incandescent lamp mounted on each



ODD SHAPED HORN WITH ELECTRIC LIGHTS

bell of the horn he uses. As he plays the lamp on the horn from which the sound issues, lights up. With the footlights out and the stage darkened, the rapid flash of one lamp after another accompanying the notes, and the reflection in the bright polished surface of the bell make the act a decided novelty.

"Telephone wires all over Edinburgh, Scotland, have been cut by suffragettes. It will be some days before communications are restored," says a cable dispatch. Consider how many more wires we have in this country to be cut.

A Sherlock of the Skies

By RENE MANSFIELD

"But I tell you it's absurd, man! You talk as though Forbes had plunged plumb through to China or was dangling from the Milky Way! He's somewhere between here and Edgarville, dead or alive, or else he and his plane have been snatched out of the heavens bodily by an unseen hand."

Ames Mitchell was pacing the brown grass, lifeless and sparse as the hair of a mummy, before Forbes' hangar. Tall, lean and nervously energetic, he was the direct opposite of the short, stocky Frenchman, of that other type of birdman, who was sitting on an overturned box beside the vacant, yawning shed.

"Of a surety, Meetchell—of a surety. But remember, my friend, we have searched every foot of ground between here and Edgarville. Not a trace of poor Forbes have we found. We see him start for Edgarville. We know that it is not possible that he go another way, because of the current. There it is. Some freak of combustion, perhaps. Pouf! he is gone—like a bubble. We do not know yet all the tricks of this wireless power. Hélas! I have no hope that we will see Forbes nor the Gull again."

"Rot!" In the single word flung at Bouvier's back, hunched into melancholy deprecation, was expressed Mitchell's faith in his friend's resourcefulness and immunity from disaster, and helpless rage at the circumstances that baffled him.

The incomprehensible fact of the case was that Forbes had started off about noon on the day before, forging straight into the blazing blue of the skies, the nose of the Gull pointed toward Edgarville, 50 miles due east, which he had intended to reach.

There were only three aeroplanes of the ten in private congress there on the remote plains of Texas that were equipped for operation by the wireless transmission of power. One of these was Forbes' Gull, another the biplane of an English aviator, Baring, and the other Bouvier's monoplane. Although the wireless control of machinery was far past the experimental stages, the radius of the electro-magnetic waves as a source of power for the motors, so far developed for the aeroplane, was limited. It was for research and practical experiments along this line that the Ferris Aero-Development Company had offered unusual inducements to aviators of international fame to join their school of aviators in the South, where they had a manufacturing plant and had also constructed a wireless power generating plant.

Guy Forbes had proved easily not only the most intrepid but the most scientifically alert of the little group of aviators. Already he had made several sensational flights in the Gull, and the morning before he had determined to test the value of some improvements he had himself suggested in the generator, setting Edgarville as his goal. When he did not return at the time he had expected, little concern was felt, although four petrol-driven planes had started over his course, to act, if necessary, as a wrecking crew. Neither they nor the automobiles that followed later had come upon a trace of Forbes or his Gull in all the stretch of 50 miles of prairie.

The thing was mysterious and uncanny. There was no chance of Forbes having suddenly decided to fly in quite another direction, because of the necessity of keeping his engine within the focused waves of electric power.

"By George"—Mitchell bit the words into the cigar he was grinding between his teeth—"if Forbes can't be found between here and Edgarville he didn't fly toward Edgarville, current or no current.

He felt that a further search of the Edgarville route would be fruitless and

the only course of procedure that suggested itself was a visit to the power plant.

It was as yet a more or less crude sort of shack set up on a sandy little hillock about a half mile from the hangars, its low roof striped with the shadowed tracery of the network of wires that depend-

Mitchell hurried on to the shack. In the palpitating heat of the bare interior, before the radio-telegraphic controller, sat Quinn, the power operator.

"Got her on today, Quinn? What's the use? No chance of anybody flying today."

Quinn looked up impatiently as Mitch-

MITCHELL BURST THROUGH THE DOOR LIKE A CATAPULT

ed from a towering "L" antenna. Mitchell's long strides brought him speedily to within a stone's throw of the plant, where he came upon Baring, the English aviator, evidently returning to camp.

"Damn it all, Baring," he burst out without prelude, "this thing's got to be cleared up. There's something mighty funny about this deal; know it?"

The Englishman, startled, looked at him sharply. "Think so, Mitchell? I'm afraid your nerves are getting away with you. So long. See you later," was all he said, as he walked on.

ell's lank figure appeared in the door.

"Had a little trouble this morning. Trying out a new generator, that's all." Quinn's tone was not cordial.

"No trouble at this end yesterday, was there?" Mitchell inquired casually.

"Don't you suppose I'd have said so before now if there was?" returned Quinn.

"Why, sure, Quinn, sure. But I got to thinking this morning that perhaps you and Forbes were trying to put one over on us. It occurred to me that perhaps Forbes didn't make for Edgarville

after all,—you may have switched the current——"

"You saw him start for Edgarville yourself," interrupted Quinn. "You know perfectly well that we haven't been able to switch the current anyway from due east since that trouble with the gearing last week. What you talking about, Mitchell?"

"O, well, Quinn, I'm all knocked out about this thing, I tell you. Say, what was Baring doing around here, anyhow, just now?"

"Search me."

Obviously Quinn was not conversationally inclined. He had turned to the wireless telegraph apparatus near by and was operating the transmitter busily.

Mitchell, with an unexplainable feeling that Quinn could throw some light on the mystery if he chose, sauntered around to the rear of the shack and looked over sharply, as well as he could, the structure of the aerials. Erected on a huge revolving disk, the L antenna was so donstructed that when its angle was automatically set at any degree of the disk a concentration of the electric waves took place which made possible their focalization in any desired direction. The L was pointed due east as it had stood for several days owing to the accident to the gearing of which Quinn had spoken.

Mitchell saw plainly enough that it would have been impossible to operate the disk in the present condition of the gearing. But suddenly his brows puckered into a puzzled frown. Then he got down on his knees so that he could examine carefully the sandy ground beneath the big disk, the appearance of which had caught his eye.

The entire area of ground within the circumference of the disk was a smooth stretch of sand, perfectly leveled by the winds, with the exception of a little groove that formed an arc of at least 90 degrees faintly traced in the sand near the rim of the disk. Mitchell on his knees saw that it had been caused by the dragging over the sand of a single wire that had somehow become detached from one of the cleat insulators on the under surface of the disk. In places the narrow line was almost obliterated, where it had probably been blurred over by the breeze. Mitchell recalled that the wind had been blowing such a gale the morning before that they had all urged Forbes not to try for Edgarville until sundown. When a freakish calm followed, about noon, that lasted all the afternoon, they had said it was more of "Forbes' luck." If the disk had been revolved those 90 degrees while the wind was blowing at that terrific rate the little groove traced by the dangling wire would have quickly disappeared.

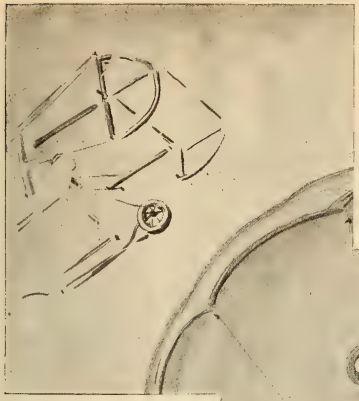
It must then have been revolved after the wind had died down.

It must have been revolved sometime between noon the day before and the moment when Mitchell had noticed the tell-tale tracing, which gave the lie direct to Quinn's statements.

There was a chance that the current had been switched while Forbes was in the air, with or without his knowledge. At least the idea suggested a course of activity for which Mitchell was grateful. Assuming that at some time since the previous noon the current had been directed almost due north, as indicated by the point at which the line in the sand was broken off completely, Mitchell determined to fly low for perhaps 50 miles to the north in the faint hope that Forbes, for unexplained reasons, might have taken that course.

When he returned to camp he said nothing of his purpose, about the hangars, but quietly wheeling his biplane onto the field, rose to perhaps 300 feet and then headed straight north.

For more than 20 miles he flew low over the flat, parched country, becoming more and more miserably certain of the futility of searching this trackless waste of land and air for a clue to the vanished aviator. Sighting presently what was doubtless a squatter's little cabin,



Mitchell volplaned to the ground near by, and jumping from his seat beat a lively tattoo on the sill of the open door. The startled individual who came running from somewhere in the rear, was struck dumb at the sight of the huge creature that had alighted practically on his door sill. Mitchell had twice to ask him if he had seen another such bird in the last 24 hours, or had had any other visitor.

Faith, and he'd never seen such an animal even in his dreams. As for visitors—Mitchell might see for himself the date of the passing of the last one, crudely carved there in the door—a date just eight months previous.

Disheartened, Mitchell climbed into his seat and took wing again, to the bitter disappointment of the squatter. Another 20 miles he flew, and with a forlorn but tenacious hope alighted to make inquiries at another cabin. At first he thought the place had been deserted, but his knock on the sagging, closed door brought forth a red-haired man who stepped outside and closed the door again behind him. He evinced no astonishment at the sight of the biplane and regarded Mitchell coldly

"Well?"

"See any other bird like that one yonder flying around these parts, partner?" inquired Mitchell. "Or had a visitor since yesterday noon—tall fellow with eyeglasses?"

"No, I ain't seen one or t'other. Birds like that 'ere ain't common round here, nor visitors, neither."

Mitchell prepared to set off again. The red-haired man reëntered the cabin, closing the door again after him.

Just as Mitchell was about to tilt his elevating planes for flight the thought struck him suddenly that it was rather odd that the red-haired man had disappeared, since he had displayed no interest in the aeroplane. It argued that he must have seen one before, otherwise he would have been bent upon investigating what to him must have been a great curiosity.

(Concluded on page 606)

I MANAGED TO GET HOLD OF MY PARACHUTE AND SWING LOOSE

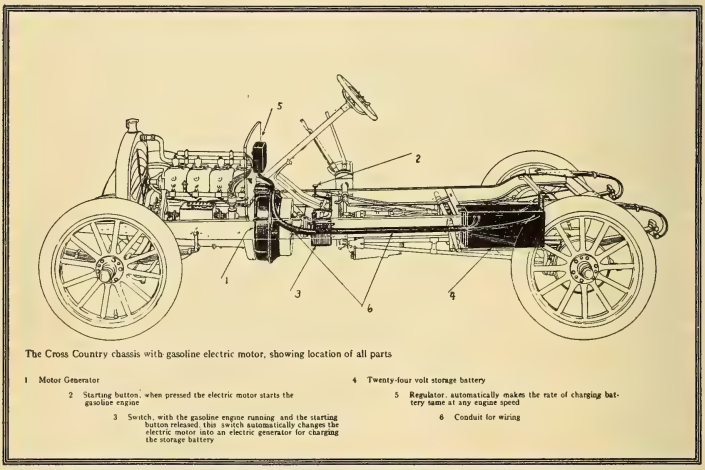
Self-Starting, Gasoline-Electric Automobile

The 1913 model Rambler Cross-Country car embodies a well thought out combination of the gasoline and electric motor. The fly wheel element of the engine and the armature of the electric motor-generator being in one, a simple and positive means of starting the engine, by simply pressing a button, is obtained.

By pressing the button, current from the storage battery is passed into the motor-generator armature, and the armature, operating now as a motor, begins to revolve. Being itself the engine fly wheel, the engine is at once brought up to a speed of 200 revolutions a minute. No cranking, kicking, back-firing, etc., accompany this operation.

After the explosions start and the engine is operating regularly the motor-generator is changed, through an automatic switch, into a simple generator or dynamo. It now pumps current back into the storage battery through a regulator which keeps the charging voltage constant regardless of engine speed.

The engine is now running the machine and at the same time charging the storage battery. When the battery is completely charged it is automatically cut out. The energy it contains, however, is always ready, at a moment's notice, to start the engine again and light all the lamps on the car.



The Cross Country chassis with gasoline electric motor, showing location of all parts

1 Motor Generator

2 Starting button, when pressed the electric motor starts the gasoline engine

3 Switch, with the gasoline engine running and the starting button released, this switch automatically changes the electric motor into an electric generator for charging the storage battery

4 Twenty-four volt storage battery

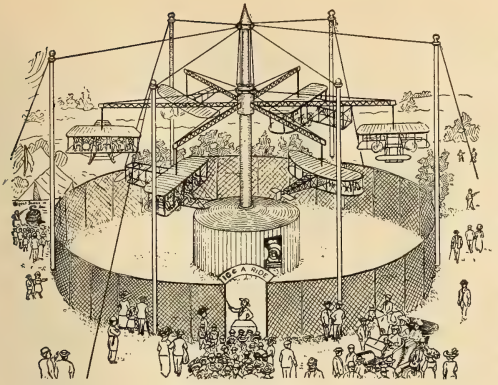
5 Regulator, automatically makes the rate of charging battery same at any engine speed

6 Conduit for wiring

Aeroplane Roundabout

Every year witnesses some new "glide," "coaster" or other amusement ride added to the equipment of summer parks.

A patent has been issued to James D. Walsh, St. Louis, Mo., upon an aeroplane roundabout. The device consists of a hollow central staff, a heavy vertical sliding ring from which steel arms extend, upon the ends of each of which are suspended monoplanes and biplanes arranged to seat several people. In operation the propellers of the machines are the impelling force of the device. At the start the flying machines are near the ground, but as their rapidly turning propellers increase the speed an electric motor within the inclosure at the center



AEROPLANE ROUNDABOUT

pulls down a counterweight within the hollow central staff, lifting the flying machines gradually into the air. Electricity also operates the machine propellers.

Radium Rays in Coloring Gems

The property of radium which gives it the power to change the color of precious and semi-precious stones has been mentioned before in these pages. But some further details of this discovery of the young German chemist, Moritz von Rohr, of the Royal Institute, London, are offered. It seems that he recently purchased several varieties of sapphires and placed them in a box with a small quantity of radium bromide. The astonishing transformations of the stones after only about one month's exposure to the radium are described as follows:

Original Color	*New Color*
White or uncolored	Topaz-like yellow
Blue	Emerald green
Violet	Sapphire blue
Wine colored	Beautiful ruby
Inferior dark colored	Deep violet

Scarcely daring to credit the evidence of his eyes, the chemist visited the jeweler from whom he bought the stones at an average price of 1s. 8d. per carat, and asked what the jeweler would offer for the "new" parcel. The jeweler, suspecting nothing, even after a close examination, offered one pound seventeen shillings per carat for all the stones, with the exception of the small but exquisite ruby colored one. For this he said he was willing to give no less than 20 pounds a carat.

An *Express* representative who recently visited the Salisbury House offices of the British Radium Corporation, Limited, the owners of the pitchblende ore rights of the famous Trenfith Mine in Cornwall, was shown several corundums of various colors which had already been materially changed from their original hues by a few weeks' contact with a small glass tube containing 50 milligrams of pure crystallized radium bromide.

"I am making these experiments in coloring precious stones more as a hobby than anything else," said the director to the *Express* representative. "They are at least very interesting.

"When I mentioned the outcome of my experiments to a famous scientist, he informed me that he was not a bit surprised, but that I was apparently merely producing in a few weeks by radium emanations the same effects achieved by Nature in many thousands of years."

The San Joaquin Light and Power Corporation of Fresno, Cal., supplies electric service to seven counties in one of the most fertile farming sections of the country, the actual area being 200 miles long by 75 or 80 miles wide.

How the Electric Won a Hat

One suburbanite was telling a friend how he became converted to the electric. Said he: "I was late rising one morning, and no matter how I hurried with the bath and the shave and the breakfast, I found the clock going faster than I could go and the last of the good trains for the city gone. I was sore at my luck, and I didn't care who around the house knew it.

"With the idea of helping matters, my wife said: 'I'm going to drive in today in my electric; let me take you.' Manlike, I laughed at her proposal, made some remarks about wishing to get into town before noon; that I wasn't merely going shopping. You know how funny a man thinks he can be under such circumstances. My wife just looked

MAN LIKE I LAUGHED AT HER PROPOSAL

at me, and said: 'Make it a new hat, and I'll be at your office in my car ten minutes before you can get there if you go by train.'

"Something in her assurance half decided me, and something taken from my failures that morning made me answer her: 'I'll take a chance if your car is ready.'

"'Car ready,' she echoed. 'An electric car is always ready. With an electric one just gets in and it goes.'

SHE DROVE ME INTO TOWN THAT MORNING

"She drove me into town that morning on time and won the hat. She called for me that afternoon and drove me home again. That was about a month ago. I haven't been on the good old suburban smoke belcher since, and the joke of it all is on my wife, for she hasn't had the use of her car since then, not even on rainy days. I have annexed it. How does she like it? Well, she says she is glad to make a sacrifice for my comfort and convenience and, besides, I have ordered a new car for her."

Electrical Developments in Minneapolis

The position of Minneapolis among the electrical cities of the country will be materially strengthened by extensive improvements now being planned. H. M. Byllesby & Company, who recently assumed active management of the Minneapolis General Electric Company, announce that they will proceed to develop 35,000 horsepower on the St. Croix River above the present 20,000 horsepower development at Taylor's Falls; also that they contemplate further water power development on the Mississippi River, amounting to approximately 80,000 horsepower, which would give a total of not less than 160,000 hydro-electric horsepower, including several smaller de-

velopments, available to Minneapolis and St. Paul and vicinity. The properties at Minneapolis and St. Paul will be connected by transmission lines and the water powers of the Consumers Power Company at Cannon Falls and Mankato also will be tied in by a transmission line running south from St. Paul.

Woodpeckers Destroy Telegraph Poles

Among the most unusual of the pests that are bringing railroads a great deal of trouble and expense is the industrious California woodpecker common to California, northern Lower California, and Oregon, says the *Railroad Man's Magazine*. These birds have found that the telegraph poles provide an ideal place for storing food and furnishing shelter and nests for their young. The birds have made them their larders for the winter.

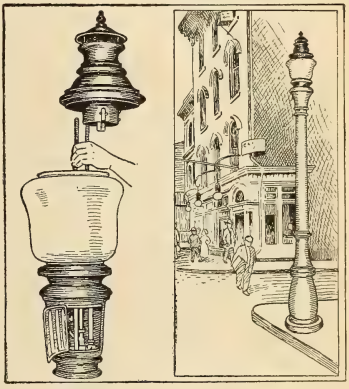
TELEGRAPH POLE PRE-EMPTED BY WOODPECKERS

The accompanying illustration shows a striking example of their destructiveness. The pole in the picture has more than 500 cavities and is useless. It was taken from a section of the Union Pacific Railroad. The boring and hollowing out of the poles so weakens them that they snap off in high winds.

Crows, jays, and squirrels raid the woodpeckers' storehouses and one of the latter birds is usually present to drive off the thieves. It is said that when the birds find desirable poles they signal one another by beating a resonant tattoo upon the timber. The sound can be heard more than a mile away.

Ornamental Luminous Arc Lamps

New Haven, Conn., has recently placed itself among the best street lighted cities of the country by the installation of luminous arc lamps. Combined with the light distribution is the



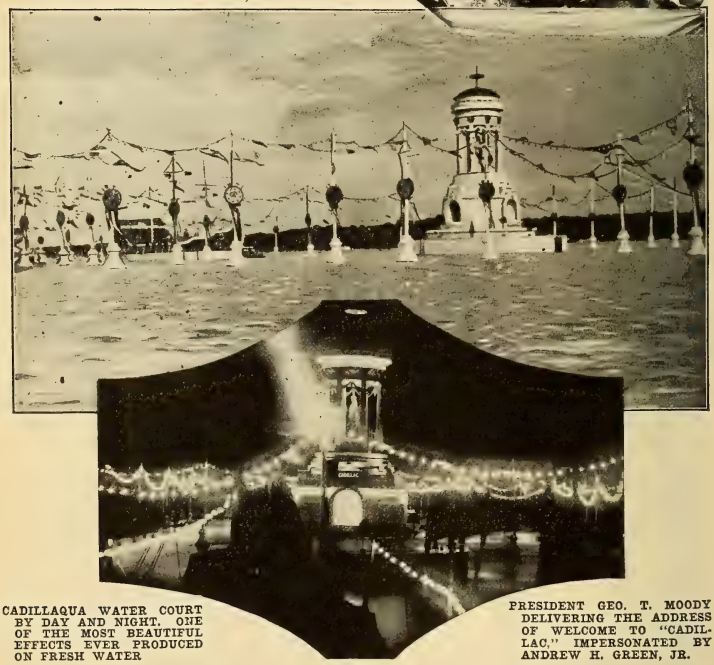
ORNAMENTAL ARC GLOBE

ornamental effect of properly designed poles for supporting the lamps. The mechanism of the lamp is below the globe, a door giving ready access. The upper electrode, which is of copper, lasts approximately 3,000 hours, while the lower electrode, which is of magnetite, is good for from 100 to 125 hours. The peculiarly shaped white globe conceals the glare of the arc and provides a clear, white light not only over the streets but upon the building fronts as well.

Ten of the largest single-phase electric locomotives ever built are now being manufactured for a Swiss railway. Each weighs 108 tons and can develop 2,500 horsepower when traveling at a speed of 50 miles per hour.

Cadillaqua — Detroit's Beautiful Water Festival

Electricity was used to paint the lily at Detroit during Cadillaqua. The wonderful Detroit River, considered by many to be the most attractive body of fresh water in America, was illuminated during Detroit's 211th birthday celebration —called Cadillaqua, in honor of Cadillac, who founded it in 1701, and the *"aqua"* on which most of the festivities were held—by an enormous electrical court built in midstream between Belle Isle Park and the American shore.



CADILLAQUA WATER COURT BY DAY AND NIGHT. ONE OF THE MOST BEAUTIFUL EFFECTS EVER PRODUCED ON FRESH WATER

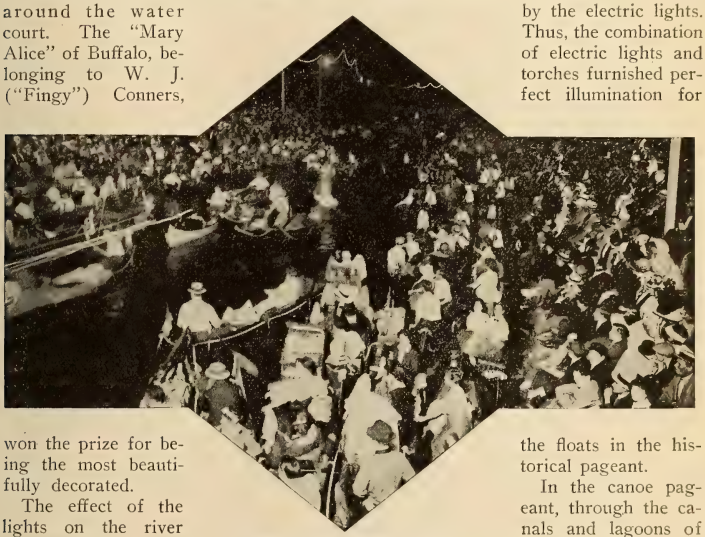
PRESIDENT GEO. T. MOODY DELIVERING THE ADDRESS OF WELCOME TO "CADILLAC," IMPERSONATED BY ANDREW H. GREEN, JR.

The court was 1,500 feet long, built on piles and featured by three immense fountains and two Roman galleys. The fountains were lighted with red, white and green incandescent lamps, while the entire fountain was surrounded with festoons of tungsten lamps. The current was brought by cable from the Detroit side of the river.

This Court of Honor was the centerpiece for a naval pageant during the big fete. It helped in the setting of what experts have called the most wonderful effect ever produced on fresh water in America.

The night of the naval parade, myriads of small craft of every description surrounded the court, to hear the music emanating from the Roman galleys—one Roman galley containing a brass band, and the other a singing society of 300 voices.

Before the program started, a parade of boats, electrically illuminated and decorated, moved down the channel and around the water court. The "Mary Alice" of Buffalo, belonging to W. J. ("Fingy") Conners, won the prize for being the most beautifully decorated.



ON BELLE ISLE LAGOON WAITING FOR THE PARADE OF DECORATED CANOES

The effect of the lights on the river produced a scene which globe trotters say never was equaled. Nearly all the hundreds of boats were electric lighted, even the smallest canoes and power boats being festooned with garlands of incandescent lamps. They covered acres of water expanse, and as the small boats danced up and down the effect on the eye, of the myriads of lights moving about, was one of surpassing beauty. Even Detroiters, to whom brilliant river effects are commonplace, were dazzled by the brilliance of this electrical display.

Electric lighting figured in Cadillaqua in many other ways, especially in the illumination of the floats in the historical parade. These enormous floats, depicting scenes from Detroit's first 50 years of history, were lighted with concealed incandescent lamps which were furnished current from storage batteries. Torch bearers marched along by the floats carrying pink torches in order to kill off whatever shadows were cast on the floats by the electric lights. Thus, the combination of electric lights and torches furnished perfect illumination for the floats in the historical pageant.

In the canoe pageant, through the canals and lagoons of Belle Isle, on the closing night of the festivities — Venetian Night—many of the canoes were electric lighted, others depending on Japanese lanterns for their illumination. Some of the canoes featured the word "Cadillaqua" and spelled it out in electric lights, the letters showing one at a time.

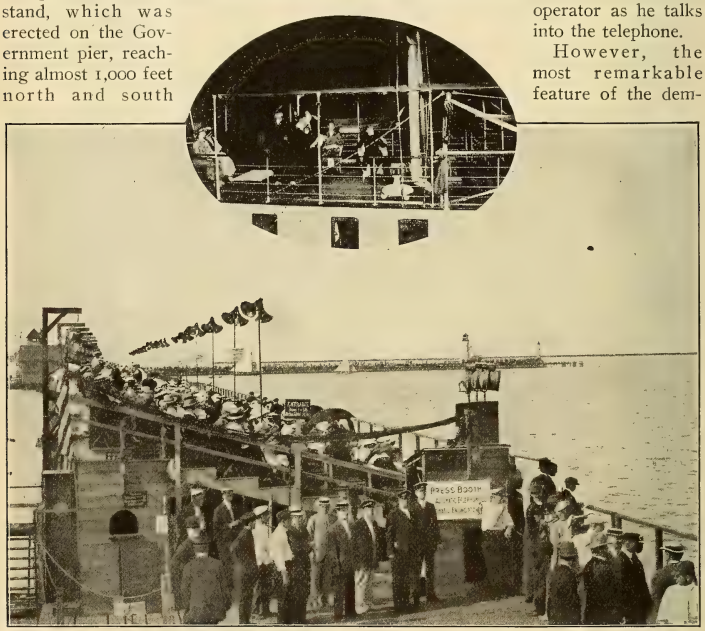
It was the electric features, undoubtedly, which seemed to please the crowds most, and, by the way, the crowds set a new record for Detroit. More people were entertained in the "City of the Straits" during Cadillaqua than had ever been there before.

Automatic Annunciators at a Water Carnival

A remarkable demonstration of the utility of the automatic telephone and automatic annunciator for reporting information regarding motor boat, hydroplane and swimming races was given at the Water Carnival and Naval Review held in Chicago on Lake Michigan, August 10-17.

Despite the fact that weather conditions were decidedly unfavorable, the demonstration was made without a hitch and showed the possibilities of distributing information to people seated out of doors in a large grand stand by means of telephone and annunciator. Because of the peculiar arrangement of the grand stand, which was erected on the Government pier, reaching almost 1,000 feet north and south from the judges' station, it was imperative that some unusual means be adopted for supplying information both as to the progress of each race and the result. Information as to the ownership, history, record and dimensions of each craft was given directly to the audience through the automatic annunciator at the beginning of each race, and then the progress of the race was made known from time to time from the judges' station far out in the lake. The moment the operator of the annunciator received this information, he spoke into an ordinary telephone, and his voice was given out to the audience through the array of horns that were strung on iron poles the entire length of the grand stand. A portion of the stand is shown in the illustration, as is also the operator as he talks into the telephone.

However, the most remarkable feature of the dem-



SHOWING THE GRANDSTAND AT THE WATER CARNIVAL FITTED WITH AUTOMATIC ANNUNCIATORS. ABOVE IS A YACHT ANCHORED AT NIGHT OFF THE GRANDSTAND FROM WHICH ADDRESSES WERE DELIVERED TO THE CROWDS THROUGH THE ANNUNCIATOR

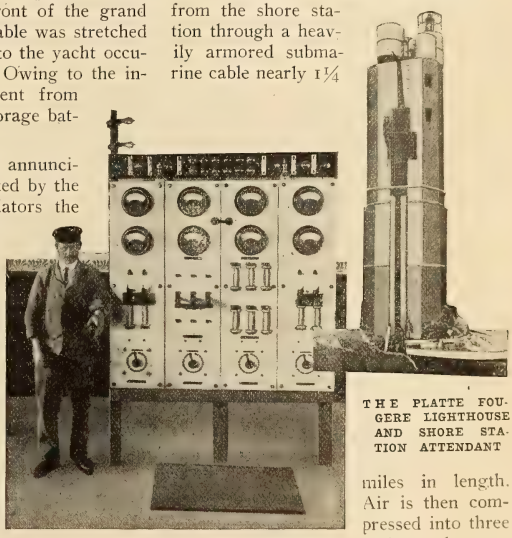
onstration was addresses delivered by Mayor Harrison, Bishop Fallows and other prominent Chicagoans through an automatic annunciator from a yacht anchored 300 feet from the grand stand on the last night of the carnival. Despite the fact that the enunciation of the speakers was in the natural tone, the voice of each was amplified 150 times, so that the vast audience could hear every word as distinctly as though the speakers were standing directly in front of the grand stand. A submarine cable was stretched from the grand stand to the yacht occupied by the speakers. Owing to the inability to secure current from the city, automobile storage batteries were used.

The telephone and annunciator system was operated by the placing of 72 annunciators the full length of the pier with 40 foot centers; that is, two horns at each post, making 36 pairs, 40 feet apart. By this arrangement no person was over 20 feet distant from a horn and the sound was so concentrated that there was no rumbling noise distributed from one section of the grand stand to the other. Also, announcements were heard in all sections of the grand stand at the same time. The entire length of the cable from the grand stand to the judges' boat was 1,135 feet. The cable was waterproof and lead covered and each of the horns at night had a covering of oilcloth because of the dampness. In addition to the annunciators, automatic telephones were installed the entire length of the pier, and the news bureaus and the newspapers had immediate access to these to communicate race results to their respective headquarters.

Lighthouse Tended from the Shore

The Platte Fougère lighthouse and fog signal, in Germany, as the first of the kind in the world, is exciting considerable interest.

The tower, a ferro-concrete structure of unusual design, contains powerful electric motors coupled to air compressors. During fog, power is transmitted from the shore station through a heavily armored submarine cable nearly 1¼ miles in length. Air is then compressed into three tanks on the summit of the tower. A clock (wound by compressed air) allows a blast to pass every 90 seconds, through a siren and horn. This fog signal has been heard to a distance of 26 miles.



THE PLATTE FOUGERE LIGHTHOUSE AND SHORE STATION ATTENDANT

The light, fixed above one of the air tanks, flashes every ten seconds, and is turned on and extinguished nightly by a clock.

The control of the motors may be accomplished from a shore station from a special switchboard, as shown in the picture; therefore the attendant need not visit the lighthouse for weeks at a time

Some Secrets of Electrical Stagecraft

By T. J. NEWLIN

PART VI

THE IMPORTANT USE OF DIMMERS

The gradual dimming of the stage lights is very important. How it is done is also quite mystifying to the layman. The lights must not be brought down too quickly or with a jump, for if they are, there is usually a little tilt between stage manager and electrician. In some cases it is the latter's fault, but more often it is the fault of a poorly constructed dimmer. Since the dimmer is one of the most important parts of a stage electrical equipment, it merits a description here.

Any one familiar with the first principles of electricity will know that when a resistance is inserted in a circuit carrying current, the flow of current will be retarded or choked down, the resistance being nothing more than a length of wire finer than the main conductor and consequently harder for the current to pass through. If a resistance is connected in circuit with an incandescent lamp, the current flowing through the filament will be reduced, and as the current is what heats up the filament and makes it glow, the insertion of resistance will cause the lamp to glow less brightly, and if enough resistance is inserted, the lamp will go out altogether.

A dimmer, used in stage work, is nothing more than resistances arranged compactly and in such manner that the electrician may throw them into or out of the circuit instantly, by means of a lever. He may also vary the amount of resistance by means of a sliding contact operated by the same lever. As shown in Fig. 31, the dimmers are made up in the form of plates or disks with the resistance wires embedded in them. These disks are then mounted behind the switchboard in banks, as shown, the number varying with the size of the stage equipment.

Now, all of the stage circuits containing the border lights and footlights of different colors have dimmers connected to them, each dimmer operated by one of the rows of handles seen in Fig. 31. These handles may be operated separately so as to control a single circuit, or in an instant several or all of them may be locked together so as to move with a single pull from the electricians' arm. Thus, by proper manipulation, the electrician is able to bring any set of lights or

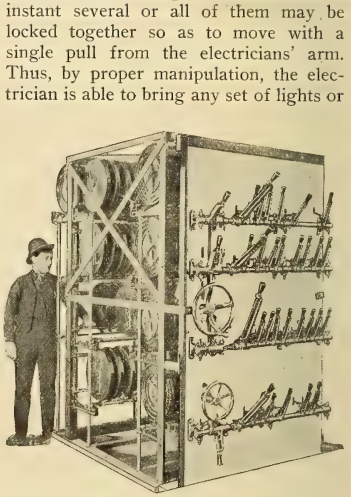


FIG. 31. DIMMERS AS USED ON A THEATER STAGE TO REGULATE THE INTENSITY OF LIGHT

all lights gradually down from full brilliancy to the merest glow, or he can perform the operation quickly, depending on how fast he moves the lever or levers. When you see the lights on the stage growing dimmer and dimmer, or coming from dimness up to brightness, you can make up your mind that back of the scenes the electrician is juggling these levers. In this way, by manipulating the intensity of the various colored lights,

such as red, amber, blue, green, etc., he helps also to produce the different color changes in sunrise, sunset, daybreak, etc.

The important thing to remember in stage work is to operate the right effect at the right time. Would it not be humorous and laughable to gaze upon an electrical change from sunset to moonlight, when, perchance, the actor might spout, "How dark it is growing! We must have light," and striking a match (to sign those papers)—the stage electrician, through negligence or inexperience, had allowed his daylight scene to stand, instead of gradually and naturally mixing his colors to produce a sunset, twilight or moonlight scene, whichever the case might happen to be?

PRODUCING THE SUNSET EFFECT

Sunset! Is there anything prettier? Is not the stage a thing of beauty as the eye beholds the gradual change? First you see the soft effect of the straw colored gelatin (or medium, as it is called behind) as it is slowly passed in front of the open light or olivette box by the several electricians behind the wings. These lamps are so set as to throw their full bath of light on stage or drops to give the best lighting effect, and as the straw colored medium is slowly replaced by the amber colored medium, the stage begins to take on that softness of the setting sun in such a manner that one hardly realizes he is viewing anything but Nature, until the amber is gradually manipulated past the arc light in the box and the deeper red medium is slowly worked into place, giving that halo of magnificence so sweet to the dream of the painter. All of this time, remember, the stage electrician at the switchboard is not idle, but is, in conjunction with his six or seven assistants, gradually cutting down through the dimmers his white lamps in the foots and borders; this allows his amber to be gradually brought up from half dimness where it was set. The red lamps are now slowly worked up through the dimmers to a full red, and "sunset" is complete.

MOONLIGHT

From the position where the sunset is left to stand, is the position from where moonlight begins. With the red lights full up, they are gradually dimmed down one-half. At this juncture the blue lights begin to show, as they have been left on "full," for the red kills the blue until the point where the mixing takes place with the red and blue, or when the red is down to one-half dimness. As the handles of the red colors are being slowly pulled down, the handles of the blues are raised to full. Perchance the scene was set at the opening to dimmed down three-fourths, but in most cases the lights are set at the "rise," as follows: reds on full; blues on full (are killed by red), and to be operated as described until the moonlight effect in all its glory shines forth. We must not lose sight of the assistants at the olivette boxes or open lamps, who, with their color mediums set at red, at the same time with the chief electrician at the switchboard are gradually replacing their red mediums with the blues. One of these olivettes or open box lights is shown in Fig. 32.

DAYBREAK

No prettier daybreak scene was ever shown than the one produced in the "Girl from the Golden West." But then we can expect this, since it is one of David Belasco's. With that infinite attention to detail that has made his name a by-word in the theatrical world, he staged this scene. Blanche Bates and her lover, "the two lives that came to naught," on the morning after the sheriff and his gang allowed her bandit lover to escape, only because they knew she loved him, are found at daybreak, lying in the open on a mound formed by the drift of the desert sand. A gray streak appears in the east as the white lights are brought up from full dimness to a slight cherry-red in the foots and borders. Then the reds are gradually cut in on the dimmers until the soft streaks of daylight appear. The

medium of the assistants is gradually changed from a soft blue on the back drops to a red, then amber and lastly straw, and the scene is complete, for the chief electrician at the board has at the same time worked up his reds to full and cut in his white, gradully working off the reds. An amber set of lamps, in place of the white, is used by some electricians to gain a softer effect.

THE SPOT LIGHT OR CHASER

The spot light, or chaser, as it is sometimes called, is used in the front balcony to spot the principals or chase the performer around the stage. It can be used also to aid in all color changes from the front of the house, behind stage, on the bridge or in the flies. Fig. 33 shows a spot light, having also a "color wheel" mounted in front of the lens so that the light may be thrown on in colors.

FIG. 32. OLIVETTE OR OPEN BOX LIGHT

WORKING BEHIND THE SCENES

Have you ever been behind the scenes? No? Then you "out front" can never realize the peculiarity of the things "behind." One, to see these men build giant houses at a moment's notice, would hardly realize how they can, from an apparent pile of junk, build the most beautiful castles or set up a pile of rocks that apparently a derrick would be unable to lift. Then, again, everything is actually worked backwards, and to the uninitiated it is quite a treat to drop in and catch these automatons at work.

And precision is the by-word on the stage, and to even whisper too loud is an unpardonable crime, especially if one of the principals or stars should happen to hear you.

At the word "strike" there is a simultaneous movement in every direction, and all of the fine castles are demolished before you could say "Jack Robinson." The electric lamps are struck and placed to one side and "props" are seen scurrying to and fro, while the "grips" are grasping the set stuff and taking it to one side; at the same time the "flymen" are doing their bit in the flies, lifting the last drops and lowering the ones for the next scene, each doing his part and doing it well.

Dark changes are made in the same order as the "strike" scene above described, only, as the name implies, all changes are made in the dark. This, of course, requires greater skill, and each man has to be on the alert. Some dark changes require anywhere from ten to 20 men to produce. In "Floradora," the musical comedy that is responsible for that famous "sextette," there is one scene where a dark change is made from an exterior to a modern hotel in 30 seconds. In order to accomplish this, no expense is spared. It must be done and done right. Any dark scene, of course, depends for success upon its being performed during the short interval of time required for the eyes of the audience to accustom themselves to darkness. Before your pupils have time to dilate, the next scene is upon you in all its brilliance.

ELECTRICIAN OPENING THE SHOW

With the audience piling in "out front" about 7:30, the mumbled cry of "half hour" comes to one's ears from somewhere above or below, in one of the dressing rooms, and the stage crew begins to make a show shop out of what was a few minutes before nothing but a barren stage. About the time the scene is set, the woeful cry of "fifteen minutes" comes from somewhere with that peculiar warning known only to the stage, indicating the curtain will rise at the expiration of that period. Ten min-

utes later the musicians are sawing away on something which from "behind" sounds like a street car passing on a sloppy day.

At the first bar of the overture in a first class theater the switch which controls the ten horsepower motor is thrown, and with a sullen grumble at having been put to work, the powerful machine starts its grind, and with a gradual movement it grips the great 30 ton steel curtain that protects the audience from fire and solemnly begins to rise. At the end of the overture the signal is given for curtain. Immediately the electrician pulls the house light switch or lowers the house lights through the dimmers. At this moment, everybody ready, the stage electrician having his proper colors set for daybreak, sunset or moonlight, whichever the case might be, the stage manager pushes the red light of "warning" to the flymen, and, assuring himself again that everything is ready, he pushes the switch throwing the blue signal to "go" upon them, and the "act curtain" is seen to rapidly rise, and the show is on.

THE UNWRITTEN LAW OF THE STAGE

There is an unwritten law of the stage that no one shall touch an electric switch, push button or anything controlling electrical apparatus about the stage. The stage carpenter, props, grips, actors, all, will not and dare not touch or move electrical paraphernalia. If anything is not right, it is up to the electrician's assistants to attend to it. Nor will the electrical department touch anything not electrical. So thus you see, each knowing his individual part, there is no misunderstanding. The assistants, since the famous Iroquois Theater fire at Chicago, dare not move outside of a ten foot boundary from their respective lamps. The penalty for doing so and being reported or caught by the fire warden is $50 in Denver and Chicago and all large cities.

IN CASE OF FIRE

All rules are thrown to the dogs in event of fire. The first one to reach the switch that controls the great 30 ton steel fire curtain throws it in; the audience must be protected first. Simultaneously all ropes controlling the stage doors and ventilators in the roof are cut with a hatchet, there for the purpose. This allows the fire doors to hold the fire in on the concrete walls of the stage, and opens roof ventilators, allowing the fire to pass out overhead. All dressing rooms having other exits, there is a chance of escape for all. The fire, being now confined to the stage, will soon pass out of the ventilators in the roof, as from the cauldron of a steel plant.

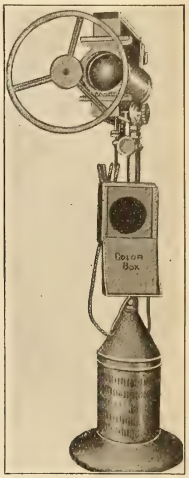


FIG. 33. SPOT LIGHT OR CHASER

THE ELECTRICIAN CLOSING THE SHOW

As the final act curtain drops to the stage, the stage electrician throws the house switch the first thing. The switch of the heavy steel fire curtain is then thrown, and, as explained previously, the latter settles to the stage apron. There is a scurrying to and fro as the final scene is struck, and with the ending of the passing out music and the cry of "All out!" from the ushers out front, the house switch is opened. The fire curtain is run up about half way and the electrician places a bunch light with five or six lamps throwing their rays from the front part or apron to the rear of the stage, so that in case of fire, any one coming in can find his way about without danger or fear of injury, and can see its location at once.

Engineering Education

By PROFESSOR FRANK P. McKIBBEN
Professor of Civil Engineering, Lehigh University, South Bethlehem, Pa.

Extracts from "Addresses to Engineering Students," edited by Waddell and Harrington, consulting engineers. This is the third of a series of similar articles by prominent educators and business men, which will be especially interesting to boys and young men who contemplate following the engineering profession.—Editorial Note.

Now that the time has arrived for engineering students to return to their respective universities and technical schools it is appropriate for them, before beginning the year's work, to survey the field with a view of deriving the greatest benefit from the time and money spent in the undertaking; in other words, to see the purpose of an engineering education.

Next to developing a strong body the student should exert his best efforts to accomplishing two things. First, he should train himself to understand and to deal with his fellow students and the teaching corps, and to make as many friends as possible in both these bodies. If this quality of mixing with men can be acquired in college, it will not only render college days more pleasant and more profitable, but it will result in a breadth of view about men and things that will make the student a more useful citizen throughout his after life. To accomplish this it is necessary, among other things, to take part in some of the various social activities which are to be found in every school, but here again a middle course must be taken and the student must not become entangled in so many of these non-scholastic activities as to allow them to absorb his attention to the extent that other features of his training are neglected. In other words, it must not be forgotten that there are several things to be gotten out of college and no student should so specialize in the social activities as to be found wanting either in the physical or scholastic training.

The power to formulate and to solve new questions which are constantly arising in industrial, in engineering and in scientific fields is what each man should strive to obtain. To this end he must acquire methods of clear thinking, habits of industry, accuracy and reliability. Let not the standard be the quality of work that will secure the lowest passing mark, but rather let it be of a quality which creates the self-satisfaction coming from having done one's best work. In other words, no man should be satisfied until he has done the best that he is capable of doing, and he must remember that it is vastly more important to himself that he sets and maintains

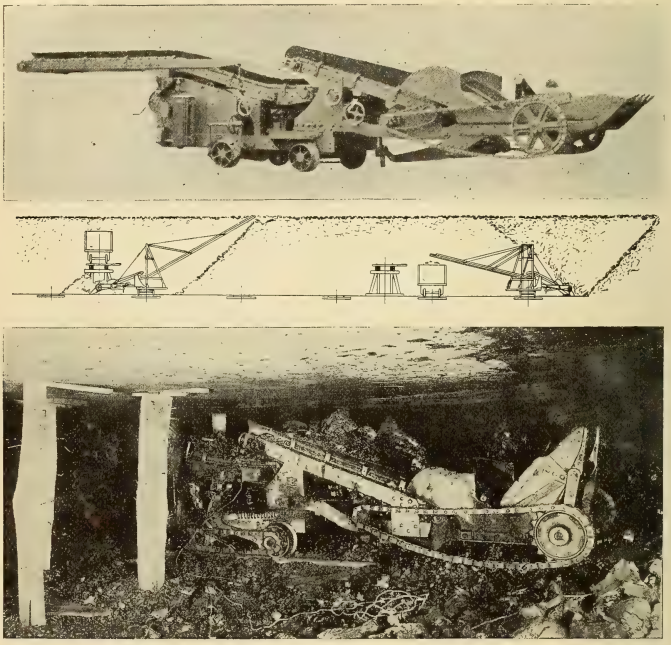
a high standard in his work than it is for the teacher, or later his employer, to set it for him.

Few students realize the value of being accurate. Unfortunately this is not altogether the student's fault, because it is the custom in most engineering schools to give more work than students can do well and then to be satisfied if they do 60 per cent of it. The 60 per cent represents the usual passing grade. Under this system it is difficult for a young man to do his best, but he should strive to eliminate errors by being constantly on guard against them. Let it not be forgotten that it is results, accurate and reliable, that are wanted; that to understand the principles involved and to make numerous arithmetical or other mistakes in their application is even more serious than not to have the principles at all. In this connection it is desirable to emphasize the importance of self training. The very best teacher can only point out the way, and it is for the student then to assume the responsibility of following it. Each man should cultivate self reliance, and should closely scrutinize his own work in order that mistakes may be finally reduced to a minimum. This question of exercising care is a very serious one, and cannot be too strongly impressed upon teachers and students in our engineering schools.

A thorough understanding of the underlying principles of chemistry, mathematics and physics is very necessary in engineering, and the engineering school is by far the best place to get it. In addition to these subjects, it is essential that attention be paid to their application, as exemplified in the study of hydraulics, strength of materials and various forms of design, such as bridge and machine design. Design is especially useful because it trains the imagination, encourages resourcefulness, develops ability to attack and solve new problems, and what is of paramount importance, it fixes the principles as no other method of instruction can. By design is meant the application of principles of mechanics to determining the size and strength of various parts of a structure without going so far into the details as to lose sight of the main problem. Let no one be deceived by thinking that he is learning bridge engineering when he is really memorizing the sizes of heads corresponding to certain commercial sizes of rivet shanks. Details such as this can be much better learned in the bridge company than in the college, while on the other hand, the principles of design can be more quickly, though no better, mastered in college.

All students of engineering should take part in the activities of their local engineering societies and should be familiar with the principal technical journals, because after graduation they will find that their college courses will really be continued in a measure by preparing and reading papers before the national engineering societies and by contributing articles to the leading engineering periodicals. Furthermore, by reading a good engineering paper there is seen the result of the applications of principles learned in the classrooms and the text-books, thus adding to the interest and enthusiasm of the college work. It is well, therefore, that while in college some knowledge be acquired of these two branches of what may be said to constitute the post-graduate course of the average engineer.

Finally, students should not attempt to specialize, but should get a broad, general training in fundamental principles, together with enough of their applications to fix them thoroughly. On the other hand, the mistake should not be made of confusing breadth with superficiality. A man can be broad and at the same time thorough.



ELECTRIC SHOVELING MACHINE

Even shoveling, that most simple form of manual labor, can now be done by means of an electric shoveling machine, which may be operated by one man and will do the work of dozens of laborers. The pictures are practically self explanatory. The powerful steel shovel at the forward end is forced under the material to be handled by the forward motion of the carriage. It is then tipped up automatically and the material falls back onto the conveyors, which carry it back and up at the same time, to be deposited on a car or dump pile. Some of the things which this machine will do are to excavate rock after blasting, and all other loose materials reasonably free from water; grade for railways; strip soil for mineral deposits; handle coal and ore in mines; take the place of stock house crews in blast furnace work, etc.

The underground electric shoveling machine used for mine service is designed to work in a space 47 inches high from the top of rail to roof, while with a shallow track work can be done in a mine or tunnel 50 inches high. The lateral swing or rear conveyor provides for the loading of cars on same track occupied by the machine or on a separate parallel track.

Tablet Commemorating First Telegraphic Train Order

To Charles Minot belongs the honor of having made the first practical application of the telegraph to railroading, at Turner, now Harriman, on the Erie Railroad, in the fall of 1851.

It was known in a general way at that time that electricity, traveling at the rate of 286,000 miles a second, could outsprint a brakeman carrying a red flag, but no one had conceived the idea of making electricity take his place.

Up to the time of Mr. Minot's initial experiment with telegraph orders, trains on the railroad were run on what was called the "time interval system." A "ruling" train had the right of one hour against the opposing train of the same class. But trainmen were anxious to get through, so that after waiting for the opposing train for a short time, a brakeman with a red flag would be started ahead and after 20 or 30 minutes the train would follow.

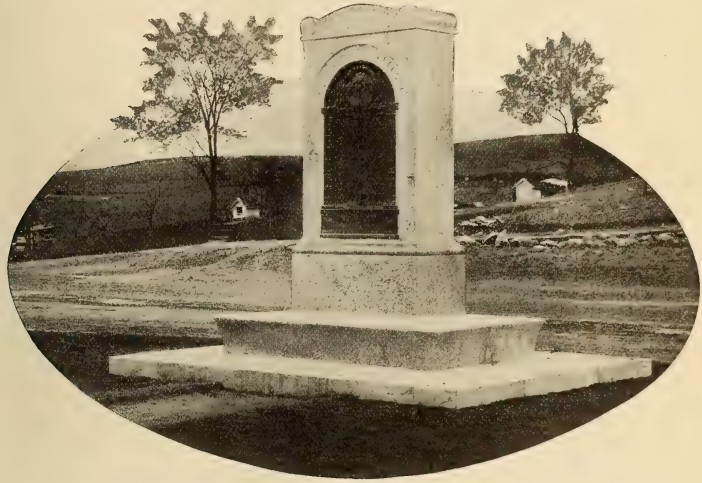
Charles Minot's operation of trains by telegraph was something of an accident. Conductor W. H. Stewart was running the westbound express train on a day when Superintendent Minot happened to be going over the road. The train, under the rule then existing, was to wait for an eastbound express to pass it at Turner's, 47 miles from New York City. The train had not arrived, and the westbound train would be unable to proceed until an hour had expired, unless the tardy eastbound train arrived in Turner within that time. There was a telegraph office at Turner, and Superintendent Minot telegraphed to the operator at Goshen, fourteen miles further on, and asked him whether the eastbound train had left the station. The reply was that it had not yet arrived at Goshen, showing that it was much behind time. Then Minot telegraphed as follows:

"To Agent and Operator at Goshen:

Hold the train for further orders.

Signed: Charles Minot, Supt."

He then wrote out this order and



TABLET COMMEMORATING CHARLES MINOT AND THE FIRST TELEGRAPHIC TRAIN ORDER

handed it to the conductor, Mr. Stewart. "To Conductor and Engineer, Day Express:

Run to Goshen regardless of opposing train.

Signed: Charles Minot, Supt."

"I took the order," says Mr. Stewart, "showed it to the engineer, Isaac Lewis, and told him to go ahead. The surprised engineer read the order, and, handing it back to me, exclaimed: 'Do you take me for a d—n fool? I won't run by that thing!'

"I reported to the superintendent, who went forward and used his verbal authority on the engineer, but without effect. Minot then climbed on the engine and took charge of it himself. Engineer Lewis jumped off and got in the rear seat of the rear car. The superintendent ran the train to Goshen. The eastbound train had not yet reached that station. He telegraphed to Middletown. The train had not arrived there. The westbound train was run on a similar order to Middletown, and from there to Port Jervis, where it entered the yard from the east as the other train came in from the west."

An hour and more in time had been saved to the westbound train, and the question of running trains on the Erie and other railroads by telegraph was at once and forever settled.

Through the efforts of Mr. E. P. Griffith, superintendent of telegraph for the Erie Railroad, the question of perpetuating the memory of Minot and the first telegraphic train order was presented to the Association of Railway Telegraph Superintendents in June, 1910, and to the Old-Time Telegraphers and Historical Association in September of the same year. Out of this action came funds by contribution for the erection of the monument 400 feet west of the new station at Turner (Harriman), and in plain view of passing trains.

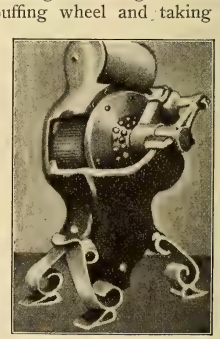
The stone from which the monument is fashioned was quarried from the Ramapo Mountains, on the Harriman estate. The stone was given by Mrs. Harriman, widow of the late E. H. Harriman, and she paid for the cost of cutting.

On its face is inscribed: "From this station, Charles Minot, General Superintendent, New York & Erie Railroad, 1851, issued the first train order transmitted by telegraph." The order given above follows. At the top of the tablet, encircled by a wreath, is a vignette of Mr. Minot. At the bottom appears the following: "This tablet was erected in November, 1911, under the auspices of the Association of Railway Telegraph Superintendents and the Old-Time Telegraphers and Historical Association."

Encircling the tablet at the top, is this inscription, cut in the stone in bold letters: "What Hath God Wrought?"

One of the Pioneers

The birthdays of this odd looking motor number at least 20, if not more. In buying out an old shop I found the motor among the salvage. It was belted to a buffing wheel and taking current



MOTOR OVER 20 YEARS OLD

from a 110 volt circuit. The base is made of wrought iron worked into peculiar shape. The ends of the armature coils are secured by two rows of screws, plainly seen in the picture, while the field coils occupy positions above and below the armature.—G. H. Novotny.

Chicago's New Police Patrol Boat No. 2

Screeching whistles and tooting horns marked the launching of Chicago's new police patrol boat No. 2, July 27. As it slid down greased ways into the river it is to guard, Miss Katherine, daughter of Chief of Police McWeeney, broke a bottle of champagne over the boat's prow.

For many years Chicago has had but one small boat to police 47 miles of river shore and 27 miles of lake front. Not until a taxicab with four passengers shot over the abutment and into the river during the opening of the bridge at Adams street did a plan for thorough river patrol make headway.

Patrol boat No. 2 is 48 feet long, eleven feet wide, draws 3½ feet of water and is equipped with a 50 horsepower gasoline engine. It is not built for speed, though capable of making twelve miles an hour against a strong head wind, but is heavy and serviceable in the rough work of dodging in and out by slips, chasing "bum boats," rescuing would-be suicides and here and there lifting a bit of wreckage from the river.

The boat was designed by DeWitt C. Cregier, city custodian and fleet captain of the Chicago Yacht Club. An electric generator and storage battery furnish current to light the boat throughout, even the starboard, port, stern and bow, lantern-like lights in external appearance being fitted with an incandescent lamp within the lantern globe. A powerful electric searchlight set upon a swivel so that it can be turned at any angle enables the crew to search the dark corners of wharves and slips, and when turned downward illuminates the river bottom as if by daylight.

AT THE LAUNCHING OF POLICE PATROL BOAT NO. 2

As proof of the confidence of Chicagoans in the ability of the boat crew in recovering people and things from the water, a man recently came and asked them to find his watch and chain acci-

dentally dropped into the river. The crew laughed and agreed to make a try for it. The loser smiled and marveled and so did the crew when the missing watch was fished out of the river ooze intact and still ticking.

Monotony is an unknown quantity to the crew and often work is well seasoned with excitement. "There's a lot of young lifters," remarked an officer at the station under the Clark Street bridge. "They'll steal anything that's loose, sneak into warehouses, pilfer in freight cars and steal fittings from unprotected boats along the river and in the harbor. The river police last year recovered $30,000 worth of stolen property and made 60 arrests.

"Then there's the rescue work. Last year 33 persons were rescued and 67 bodies recovered from the water. Most of the people who try to 'end it all' by jumping into the river, change their mind as soon as they hit the cold water and are mighty glad to have us pull them out."

Two crews of four men each will operate the new boat.

Emergency Pumping Outfit

Four cloudbursts in 30 minutes brought on Denver a mountain of water which did much damage in the residence as well as the wholesale district, flooding cellars and carrying several acres of land with much débris down the cement walled channel of Cherry Creek. Misery was to be found everywhere that the flood had touched. Great demand existed for pumping devices, and the supply houses were unable to meet the demands. Electric motors, gasoline engines and muscle were used to operate the pumps, in many cases at very exorbitant rates—as high as $50 per day for the apparatus without the operator.

The Denver Gas & Electric Light Company had in its garage, which was in the flooded quarter, the chassis of a 2,000 pound General vehicle truck, and quickly mounted thereon a fifteen horse-

EMERGENCY PUMP IN THE DENVER FLOOD DISTRICT

power motor, belting same to a centrifugal pump with a capacity of 600 gallons per minute. The truck was driven on the sidewalk and 20 feet of five inch suction hose, with foot valve, etc., placed in the flooded basement. A 3½ inch discharge pipe carried the water to the street, where it had ready access to the storm sewer. A temporary connection of duplex cable was made to transmission lines which were in the alley adjoining. The pump was started, and in a surprisingly short time much of the mud and all of the water had been deposited on the street, and a comparatively clean and dry cellar left under the building.

After this trial, the outfit was sent to aid others who were flooded out. The charge for the motor was $2 per hour, with a minimum which covered the time necessary to make connections. Thirty-six thousand gallons of mud and water were deposited each hour from this impromptu cellar pump. The time needed varied from 20 minutes to three hours.

Shooting by Searchlight

It is always a pleasing spectacle to watch searchlight drills at night, either from shore batteries or battleship fleets. But a real, live target practice by search-

TARGET PRACTICE AT NIGHT BY SEARCHLIGHT—NOTE THE FLASHES OF THE TWO BIG GUNS AND THE FINE LINES SHOWING THE PATHS OF THE SHOTS

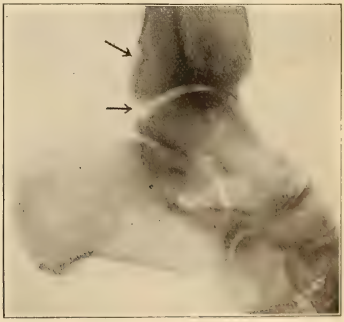
light, with solid shot and targets carrying red lights, is a bit of the spectacular one can't find in a wild west show or a circus.

These lights are powerful and throw a brilliant beam for long distances out to sea. They are so powerful that the gunners are able to find the target at night while it is being towed by a tug at a fast clip at long ranges. When once spotted the bombardment begins in earnest. Shooting big twelve and sixteen inch guns at night is no work for children, and practice at this time is more or less dangerous, not only to the gunners in the batteries and the men on the tender doing the target towing, but it is extremely hazardous for shipping, especially to small pleasure craft.

Some good records have been made shooting at targets at night by the aid of searchlights, and in time of actual warfare with a big target like a moving dreadnaught the artillerymen feel that they can "hold the fort" longer than did the Russians at Port Arthur.

X-Ray in Observing Bone Structure

The X-ray photograph reproduced herewith demonstrates an important phase of the utility of the ray. The subject had developed a lameness the cause of which was not evident until the picture was taken and the negative developed. Then, at the arrow points, faint but positive indications of decay of the bones were discernible. The ordinary observer would probably pass these over, but a skilled physician notices them immediately.



ARROWS POINT TO THE DISEASED BONE STRUCTURE

A 60,000 Egg Incubator

At Muskogee, Okla., there has been built a mammoth electric incubator of 60,000 egg capacity. The incubator itself is a low brick building 20 feet square. When you go to visit it, under the guidance of Mr. Hastings, the inventor and owner, you do not simply look into it—you enter and walk around inside. A

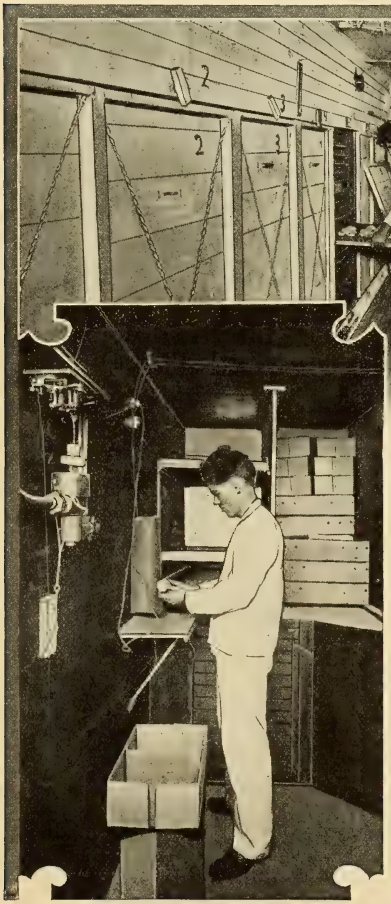


FIG. 1. MR. HASTINGS TESTING EGGS. IN THE FOREGROUND IS THE TEMPERATURE REGULATING VALVE

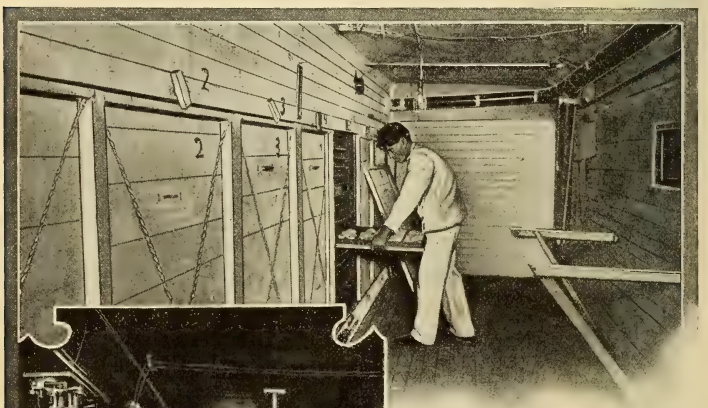


FIG. 2. THE EGGS MUST BE TAKEN OUT AND TURNED THREE TIMES A DAY

building of this size, filled with old style incubators, would have capacity for only about 3,000 eggs.

Under this roof can be hatched 60,000 eggs at one time, although accommodations for 30,000 are now all that are needed. The full 60,000 capacity can be ready for work, however, upon a few days' notice. The large capacity is attained by superimposing 20 trays, one above the other, so that 5,000 eggs fill a single chamber measuring about 2 by 4 by 4 feet.

The big idea in the hatching business is to get cheap chicks; and space economy, such as this mammoth incubator gives, along with the low cost of equipment, will tend to not only produce cheap chicks, but more chicks, and stronger ones.

It is a very simple idea, that of placing the trays one above the

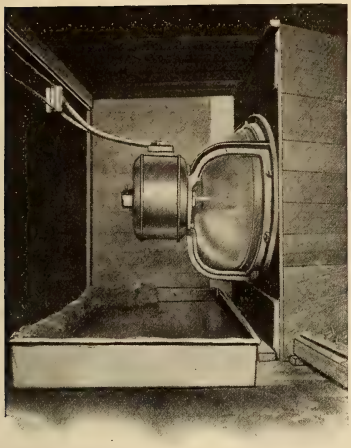


FIG. 3. THE VENTILATING FAN, LIFE OF THE INCUBATOR

other, and, like all other simple ideas, it has been tried before, but failed to work on account of the fact that it was hard to heat up such a large mass of eggs and maintain the temperature constant at all points. This was overcome, however, by the use of an electrical centrifugal fan, which drives a blast of warm air through the eggs from top to bottom and heats the entire mass of eggs (or cools it) at the will of the operator.

Upon entering the hatchery, we are first taken into a small anteroom, as shown in Fig. 1. The natural gas line which furnishes the gas for heat is shown on the wall and passes through a mercurial float valve, which is automatically controlled by the thermostat of home-made construction. This thermostat is set to operate at a desired temperature so as to close off the gas when the room becomes too hot. There are two other such arrangements on the same line, merely to check each other, so as to insure the gas being shut off when the temperature rises, and make a positive prevention against ruining many valuable eggs. The man in the picture is Mr. Hastings, who is testing the eggs for fertility.

The anteroom contains a compartment, shown in Fig. 3, in which is placed the ventilating fan, the life of the incubator. Outside air can be admitted to this compartment whenever necessary. This also shows the pan of water underneath the fan, to keep the moisture in the air at the right amount. This fan is supplied by central station service of the Muskogee Gas and Electric Company, and the owner of the incubator keeps a duplicate on hand at all times to immediately put in place should a breakdown occur. As a stoppage of ventilation would make it necessary to throw away all the eggs in the incubator and start over again, it will be seen that the dependability of the central station service is the biggest point of the whole process.

From here we enter the main incubator, in which the temperature is constantly kept at the right amount—about 100° F. The attendant will be seen, in Fig. 2, pulling out trays of eggs for turning, which is done three times a day

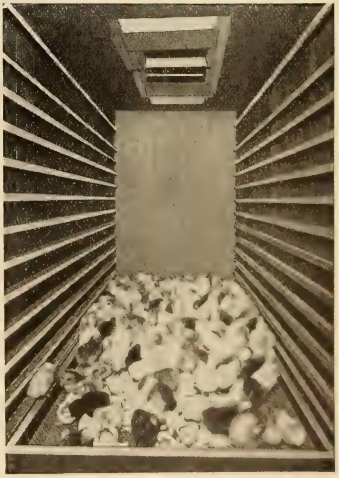


FIG. 4. A "GRAND OPENING"

by hand. In this runway the first experiments in forcing chicks by aid of the tungsten lamp were carried on. By a special time switch, light was furnished the baby chicks for eight hours, a 60 watt tungsten lamp being used, and then their light was shut off for eight hours. Fig. 4 shows a tray of chicks just out.

Mr. Norman B. Hickox, who is the contract agent for the Muskogee Gas and Electric Company, remarks: "We are always striving for business at a high load factor, so you can readily see that our friend Hastings runs his chicks at nearly 100 per cent load factor, thus resulting in an efficiency so increased that the electric chick four weeks old by far outweighs his (or her) brother or sister brooded in the old way at 66 per cent load factor."

A Landmark that Turned a Trolley Line

The new trolley line from Los Angeles to Van Nuys and Lankershim, now under construction, met with an obstacle which proved insurmountable, in the shape of an ancient sycamore tree. This was used in the early days by government surveyors in running their lines and is under federal protection as a landmark. Permission to destroy the tree and set a metal mark flush with the ground was denied, and therefore it was necessary for the tracks of the new electric line to be laid around the tree, making quite a detour. The view shows a construction train before the old sycamore, and indicates the position of the landmark, squarely in the middle of the proposed tracks. The tree is located in a narrow gap in the hills above Hollywood, known as Cahuenga Pass.

Milking Cows in the Pasture

The latest step towards securing a maximum yield of milk from high grade cows has been taken on the Hobrechtsfelde dairy farm near Berlin, where the owners first objected to the use of milking machines on the ground that these would require the cows to be driven to the barn for the milking. Such a tramp invariably decreased the flow of the milk from each cow, so the old method of hand milking was retained until electric circuits had been strung around the farm for operating other machinery.

Now the milking is done by electricity, while the cows are out in the open pasture, thus securing the maximum output of milk from the herd, and enabling one man to milk five or six cows at a time. The milking machines in this case are of the type embodying an individual motor and pulsating pump for each machine.

THE ANCIENT SYCAMORE IS A GOVERNMENT LAND MARK

The Steno-phone

The Steno-phone is a new office convenience, combining some of the operating features of the dictograph. The inventor is Mr. M. Bernays Johnson, of St. Louis. It is essentially a small desk telephone, but has no stand or mouthpiece, and takes up but a few inches of space. It is to be used for dictating to a stenographer in another room, when the dictation may be either direct or through shorthand notes, and as a means of communication between a number of departments in a large firm. For instance, the manager can be in touch with the filing department, bookkeeper, buyer and so on. The person using it does not have to keep his mouth near the transmitter, but can sit or stand at his convenience, anywhere in the room, speak in an ordinary tone of voice, and be sure that the other party will hear him.

The instrument has two parts, known as the dictator and the receptor. The receptor is shown in the picture. The dictator consists of a small box, some four inches square and about two inches in height, which contains a specially patented microphone, a pearl push button and a sensitive receiver, also the subject of a new patent. The receptor is similar to the dictator, with the exception that a bell is provided to attract attention, and that the cord leading from the box to the receiver is made longer. A receiver of the head band type is used on the receptor.

When the correspondent wishes to use the Steno-phone, he switches on his instrument and rings the person at the other end. When he is through dictating, or giving instructions, he simply cuts off the instrument with the switch, and his private office is thoroughly private; there is no stenographer to overhear conversations, and in the particular case of the stenographer, the time saved through her coming to the office, taking the letter in shorthand and returning to the typewriter is saved. Should the man in the private office wish his conversations to be overheard, however, he can switch on the current, give a signal on the bell, and the stenographer will take a memorandum of all that passes.

OPERATOR WRITING DICTATION, TRANSMITTED FROM ANOTHER ROOM THROUGH THE STENO-PHONE

Another use of the machine can be seen in the office of the buyer. An interesting example of the value of the Steno-phone in this regard occurred in a di-

rectors' meeting of a large coal company which was considering the purchase of a wireless telephone outfit for use in one of its mines. The agent of the wireless company was on hand, with instructions to bid as low as $1,500 if it seemed necessary. When the subject of price came up, the coal firm admitted that its telephone equipment was costing about $5,000 a year. The salesman said that he could save them their wire equipment at the very least. The president sent an office boy to the cost department and got the figures on the cost of the wire equipment. When the paper with the figures in question was placed on the table, the salesman got a glimpse of the figures, which made the wiring cost the mining company about $1,500.

When asked as to his price, he named $3,000, and a little later the deal was closed at $2,500. Had the president used a Steno-phone, he would have saved $1,000, for the salesman could have been worked down to his extreme figure, as he had no way of knowing the cost of the company's wire equipment.

Men Wonder at New Audit Machine

In the Baltimore & Ohio Central Building there has been for a short time a set of machines that rather awe the observer. They are uncanny. All a man has to do is to punch a few holes in cards and then those machines, operated by electricity, make the cards fairly eat, sleep and talk.

The machines are in the departments of C. C. Glessner, auditor of coal and coke receipts, and L. A. Lambert, special accountant of the road and in charge of merchandise receipts. They are used in proving shipment reports. For example, a shipment report comprising hundreds of waybills reaches the department. On each waybill are a half dozen or more sets of figures, and the total of each set of figures for all the waybills is stated in the report. That must be proved, and hitherto it has been done by unrelieved clerical labor.

Not so now. A young man sits at a table before the first of three machines. It is called the punching machine. In front of him is a stack of waybills, piled high. Beside him is a stack of cards on which are numerals—and that is the beginning.

The station where the waybill originated has a number, and so, in the station space, the numerals on the cards are punched for that number; the date when the shipment originated is punched; the weight of the shipment; the freight charge on it; the advances, if any, and the amount, if any, prepaid. Thus on a card about seven by three inches there is a complete record of the particular shipment covered by the waybill. And the young man who does the punching can hold a pace of 2,000 cards a day without strain; can hit it up to 3,000 if necessary.

From the punching machine the stack of cards, which duplicate all the waybills of a general shipment, goes to the next machine of the set, the tabulating machine. There the stack is fixed on a shelf, a button is touched and away it goes, handling the stack at the rate of 150 cards a minute. When it is used up, somebody turns a lever, and you have your totals for the stack—so many pounds in the weight column, so many dollars in the freight charge column, so many dollars for advances and so many dollars for freight prepaid.

The stack of cards passes to the third machine, the assorting one. That one is a sort of commander of cards. It saith to one card, "Come," and it cometh; to another, "Go," and it goeth. And it tells them to "go" and "come" at the rate of 260 a minute. Any old way the man in charge of the machines wants those cards assorted after the shipment has been proved is done.

There are seven colors of cards used in connection with the machines for corrections. Cards for additions of this and for deduction of that; cards for addition

of that and for deduction of this and so on.

One day in Mr. Glessner's department a general report of shipments came in from Loraine, Ohio. There were 771 waybills in it, and the young man who did the punching of cards for each of the waybills finished up the job in two hours and ten minutes. The next machine, the tabulating one, which produces the totals, handled the stack of 771 cards in a little over five minutes.

Brain a Telephone Exchange

R. J. writes: "Has the size of one's head anything to do with the intellect or the amount of brains? Bumps projecting from either side of the head—do they indicate any extraordinary brightness? Does a bulging forehead indicate a strong memory? Where does the memory brain lie, and where the intellectual brain?"

REPLY

1. No.
2. No.
3. No.
4. Some of the functions of the brain are accurately localized; others are not.

Memory, as such, has no center. Memory of an act resides in the centers having to do with that act. It is like a man walking in the snow. The tracks are where he walked. Nobody goes around, gathers up tracks, and carries them to a center. Going over things in memory is walking in tracks.

The brain is a telephone exchange. Its quality depends on the wires which come in, and the perfection with which the different boards are "hooked up." A good brain is one with lots of wires running in and out, lots of switchboards, lots of wires running from switchboard to switchboard, and good insulation, so that the wires never cross or ground.

In the brain the system is partly automatic and partly worked by operators. Most of the operators sit at switchboards over the eyes and up to the hair line. But there are others sitting all around, some at the back of the head, and others right over the ears.

The quality of the work done by the brain is determined by how well the exchange is organized; how often one gets the wrong number when he rings, or the busy signal when the line is not busy, or a crossed line, or 'phone out of order, or an electric shock—these are the things which show a brain to be poor. It is not the size or bulk which means intellectual capacity.

Bumps on a head have no more to do with brain work than a bay window on a telephone building has to do with the girl who sits at the board in the "Wabash" exchange of a large telephone system.—Dr. W. A. Evans in the *Chicago Tribune*.

An Electrical Scarecrow

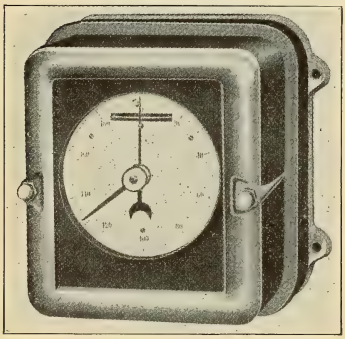
Scarecrows lose their effect when the birds become used to their stationary appearance. A Glenn Ellyn (Ill.) genius with an electrical bent makes use of an

electric motor with suitable cranks and rods to cause the arms and legs of the scarecrow to do all sorts of wild movements, with the result that birds, especially the wary crow, give his sweetcorn and garden a wide berth. From the motor wires run to a switch in the house.

Ampere Hour Meter for Electrics

Every electric vehicle owner understands how important it is to know the exact condition of his battery.

The Sangamo ampere hour meter does for the vehicle owner what a cash register does for the merchant—shows everything that comes in and goes out and keeps an exact record of it.

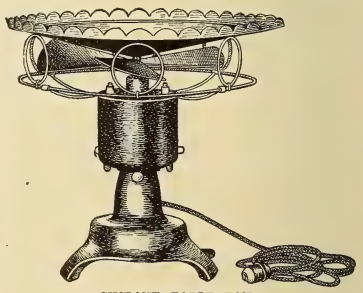


AMPERE HOUR METER

The meter is a small electrical recording instrument, accurately built, arranged on the car so that all current from or to the storage battery will pass through it, making it run at a speed in exact proportion to the current flowing each moment. The revolutions of the meter disk are added up by suitable mechanism and recorded on the large circular dial as shown in the illustration, so with proper adjustment of the meter speed the dial reads in ampere hours—just as a clock reads hours. The large indicating hand starts from zero and runs on discharge in the direction of the hands of a clock, showing at any time just how much you have taken from the battery, and, knowing the total capacity, therefore, just what you have left. The hand moves back the other way on charge and the meter is so designed as to run somewhat slower backward than forward by a percentage which may be easily adjusted inside the meter. This arrangement gives automatically the necessary extra charge for the battery, amounting to from ten to 20 per cent more than the quantity discharged. By allowing the large hand to touch an insulated contact at the zero mark, a circuit-breaker may be operated, thus cutting off the charge.

A New Electric Fan Creation

Something new in electric fan design is shown in the accompanying illustration of the Cyclone fan. It has a deflecting plate above the fan blades, which rotate in a horizontal position, forcing the air against the plate in such a way as to produce a pleasant upward circulation of air. The motor has three speeds and operates from the lamp socket.

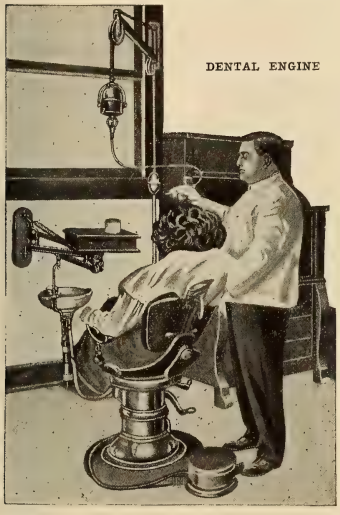


CYCLONE TABLE FAN

Dental Engine Operated by Dry Cells

The most important piece of apparatus in a dentist's office is the dental engine which operates the drilling and grinding tools as they are held to the teeth.

The old style foot power engine is still used, but is rapidly being displaced



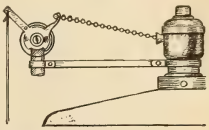
DENTAL ENGINE

by the electrically operated machine. In the illustration, one of the new machines is shown suspended in position from a wall bracket. On the floor just back of the chair is the foot controller, which enables the operator to regulate the speed of the engine from either side of the chair and vary the revolutions of the drill over a range of from 1,800 to 3,500 per minute.

One of the features of the Butler dental engine is that it will run on either direct or alternating current or upon the cells of dry battery where current from an electric light company is not available. These cells are put up in a neat wooden cabinet supplied with the engine.

Lamp Socket Attachment

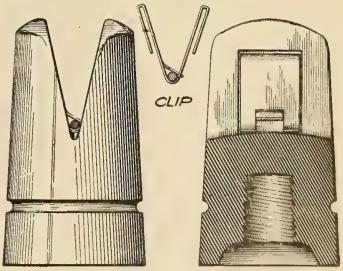
The ordinary pull chain socket cannot be conveniently operated if the socket carries a reflector or enclosing globe about the lamp bulb. A patent having this point in mind has been granted to William Haas, New York City. An arm with a clamp to secure one end to the lamp socket and a bell crank lever mounted on the end of the arm serve to pull the chain and light or extinguish the lamp by means of a pull cord attached to the bell crank lever arm.



LAMP SOCKET ATTACHMENT

A New Insulator

Thomas H. Watkins, of Wakpala, S. D., is the inventor of a new type of insulator to hold a conductor without the use of tie wires. The insulator proper is made with a deep V shaped notch in the top. In this notch are re-



INSULATOR

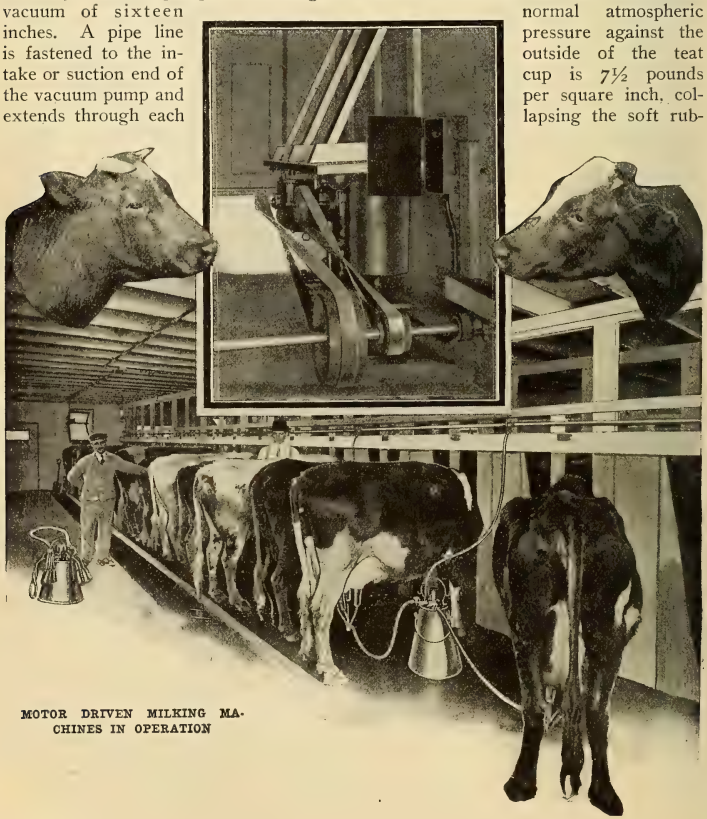
cesses into which is sprung a clip, shown in the drawing. This clip holds the wire securely down in the bottom of the V when the clip is sprung into place, the little downwardly projecting tongue of the clip pressing down tighter as the top wings of the clip are pinched together to force them into the recesses.

Motor Driven Milking Machines

Motor driven milking machines of the vacuum type have given very satisfactory results in Denver, the "City of Lights," one mile above sea level. A brief description of one of the installations shows the simplicity of the equipment and its application, as well as the feasibility of this type of milking machine for milking even the most refractory cow.

A two horsepower motor is belted to a rotary vacuum pump maintaining a vacuum of sixteen inches. A pipe line is fastened to the intake or suction end of the vacuum pump and extends through each barn over each row of stanchions. A petcock is connected to a vacuum pipe between each two cows. By this means a milking machine can be so attached that any cow or any number of cows can be milked in any barn by using a rubber hose connecting the machine to the petcock.

In each milking set of four bell shaped rubber cups, one longitudinal half of each bell is of hard rubber so that it will not collapse, the other half is of soft rubber. With a sixteen inch vacuum the normal atmospheric pressure against the outside of the teat cup is 7½ pounds per square inch, collapsing the soft rub-



MOTOR DRIVEN MILKING MACHINES IN OPERATION

ber and squeezing the teats against the hard rubber side. A soft rubber sleeve is vulcanized to the large end of the bell shaped cup and fits snugly over the cup to keep air from leaking in. With the cup in position the bell hangs inverted with the point down. The milk runs to a point where a heavy rubber tube is connected with a small clear glass funnel provided for the inspection of milk and also shows when the flow has ceased. The rubber tubes from each of the four cups are vulcanized into a larger tube through which the milk is drawn from the vacuum into the closed tank.

The tank used to collect the milk is of six gallon capacity and shaped somewhat like an inverted milk pail.

The air pressure exhausting into a vacuum is used to operate an air engine built into the top of the tank. This engine is so arranged as to admit air to the tube at each reciprocation of the engine for a very short part of a stroke, destroying the vacuum in the tube and cups and allowing the cups to expand momentarily. When the air port is closed by the further travel of the tube, the vacuum is again established in the tube and rubber cup. The soft cup again collapses from outside pressure of air, thus eliminating the pull and jerk of the hand milker.

The number of pulsations per minute can be varied by adjusting a valve which increases or throttles the air expansion, thus speeding up or slowing down the engine. Hard milking cows may require a speed as slow as 50 pulsations per minute, while easy milkers can be milked by as low as 70 strokes of the valve per minute.

A two machine outfit will milk 20 cows per hour of average milkers and save the expense of one man milking by hand. The advantages claimed for this system are: It lengthens the fresh life of hard milkers; the milk is never touched by human hands, and is not exposed to the air, dust or dirt of the barns.

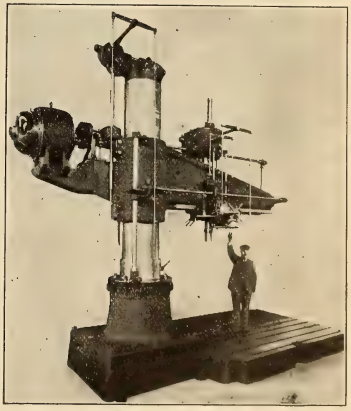
Wall Pull Switch

We are familiar with the pull chain socket, but the application of the chain to a wall switch is somewhat of an innovation. The illustration shows the Hubbell wall pull switch with a metal cover ready for installation. A slight pull on the depending chain turns the light on and off as in the case of the ordinary pull chain socket.

A Giant Drill

That an electric motor often operates a machine many times larger than itself is well illustrated in this picture of the Asquith radial drill made for heavy work.

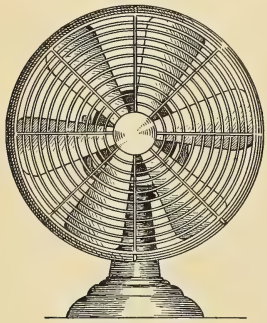
Some idea of the size of the machine is given by comparing it with the man standing under the arm. While serving as a counter-balance, the motor by means of rods and gearing moves the radial arm up, down or around the massive pillar to bring it upon the work. The same motor also furnishes the necessary power which is necessary for the operation of the drill.



A DRILL FIVE TIMES AS TALL AS A MAN

New Type Fan Guard

A new type of fan guard, manufactured especially for the Electric Shop, Chicago, consists of concentric circles of wires close together in front of the fan and also about the fan blade tips. The fan is thus enclosed in a veritable network, which precludes the possibility of the baby or a careless individual getting the fingers dangerously close to the blades. Another feature is the use of six blades instead of four, a reduction in the amount of vibration

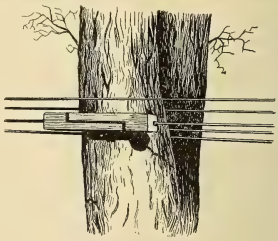


UNIQUE FAN GUARD

being thus secured, the fan running almost noiselessly. Since this fan will be largely used in residences and offices, the guard is neatly finished in bell copper.

Tree Insulator

Part of the telephone lineman's work consists in keeping the wires clear of trees and their branches, which often afford a good ground. The Morse tree insulator here shown is simple and quickly placed on the wire. It is a rectangular piece of wood that may be placed on a wire by means of two crosswise grooves deep enough to meet a shallow groove on the face. The wire passes from one crosswise groove along the face groove and out by way of the second groove, the middle of the insulator thus held by the wire bearing



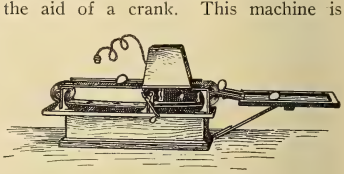
TREE INSULATOR

against the limb or tree without the use of nails or other fasteners. The wood for the insulator is thoroughly waterproofed.

Daylight Egg Tester

An electric daylight egg tester has been invented by Mr. S. J. Fish, of Jackson, Michigan, which will be an innovation in the poultry and produce business, for it is far ahead of candling in a dark room.

Electric No. 2, as it is called, is about three feet in length and contains a belt, with small metal trays about six inches apart for holding the eggs, which is run over rollers at each end of the case by the aid of a crank. This machine is



EGG TESTER

equipped with an electric lamp and a cord attachable to any electric light socket.

A hood with an opening is placed over the lamp and, as the egg passes over it, the light flashes on automatically, remaining only so long as the egg is under examination; a perfect one is a clear deep orange color, while a bad one is

black; the eggs turn automatically on the belt, enabling the tester to examine from all sides. The good eggs are allowed to roll out on a canvas table, which is done without danger of breakage, while the operator discards the ones which are spoiled.

When the ordinary lighting current cannot be secured, the machine is equipped with 24 dry batteries in multiple series, which furnish current for low voltage electric lamps.

An expert and two helpers can test about 80 cases per day with absolutely no danger from fire. Eggs are tested in a daylight room, and with great rapidity.

Car Cleaning While on the Way

The portable vacuum cleaner has simplified the cleaning of Pullman and observation cars on through trains. At one time at division points the car cleaners, with broom and dust pan, would enter cars, and while discommoding passengers, would do a poor job of cleaning. Today the cleaning is easily done while the train is on its way.

The Utility electric cleaner, without filling the air with dust, cleans the floors and cushions, depositing the dirt in a dustproof bag. The apparatus, though small, is effective and is equipped with a motor to suit the current.

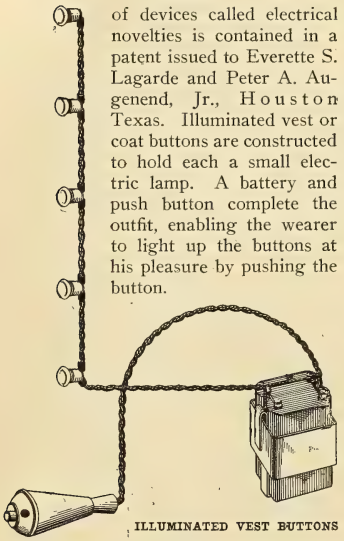
CLEANING THE OBSERVATION CAR EN ROUTE

Magnetic Chuck

A magnetic chuck is one of the newest machine shop appliances, being made to hold work on the flat beds of planers, millers, grinders, etc. The chuck is fastened to the bed of the machine. Its face contains the poles of a number of electro-magnets. By pulling out a handle on the controller, current is sent through the coils of the electro-magnets, which become very strongly energized, holding the metal piece to be worked firmly in place. For certain classes of work, as, for instance, grinding file blanks, thickness gauges, etc., it beats the old style chuck, as thin stock can be held for grinding on one face without distortion due to clamping its edges. For heavy work the holding power would not be sufficient, like everything else, it has its limitations.

Illuminated Vest Buttons

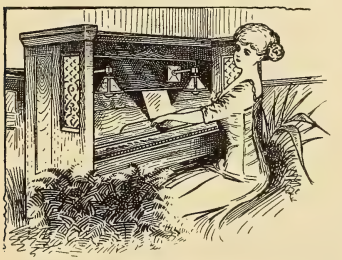
An addition to the class of devices called electrical novelties is contained in a patent issued to Everette S. Lagarde and Peter A. Augenend, Jr., Houston Texas. Illuminated vest or coat buttons are constructed to hold each a small electric lamp. A battery and push button complete the outfit, enabling the wearer to light up the buttons at his pleasure by pushing the button.



ILLUMINATED VEST BUTTONS

Lighting Fixtures Part of Piano

Something new and different in piano lighting is being put forward by one manufacturer who makes the fixture a

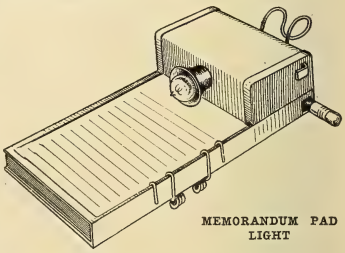


NOVEL PIANO LAMP

part of the piano. With the advent of wooden fixtures the matter of harmonizing these with the general appearance of the instrument should not be difficult.

Light for Memorandum Pad

It is well known that many writers keep a pencil and pad at hand to copy a choice sentence, an expression or a word that is called to mind, knowing that to let it pass may mean inability to recall it. To some this peculiarity is strongest just after retiring, and this fact has led Otto Knoerzer and Joseph W. Weis, of Hammond, Ind., to patent a small bat-

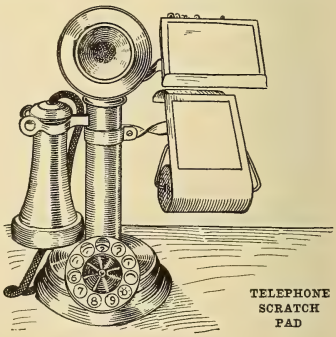


MEMORANDUM PAD LIGHT

tery and lamp to which is attached a memorandum pad. The pad is held in place by a spring, as illustrated, while a lamp is arranged to illuminate the leaf.

Telephone Scratch Pad

There are many telephone scratch pads designed to have the paper in the right place. The illustration shows one in



TELEPHONE SCRATCH PAD

which the paper is held upon a roller so that it may be drawn off as needed.

Electrical Men of the Times

FRANK MORRISON TAIT

One of the most exact standards by which a man can be measured is the opinion of him held by those who are employed by and work with him. By this rigid scale Mr. Frank Morrison Tait, president of the Dayton Power and Light Company, Dayton, Ohio, measures a full man and every employe swears by his president. On the other hand, Mr. Tait knows each of his men and not only that, but each man's family.

In his youth, his boy friends will tell you that his sympathies always went out to the boy or animal that was putting up a good fight on the right side and getting the worst of it, and this spirit of absolute squareness impresses everyone who comes within reach of his personality.

Mr. Tait believes firmly in the public. "Any one who wants to see me can walk into my office at any time without being stopped by an office boy or a secretary and without being asked who he is, what he wants, or 'Have you a card?' It takes up time, but it pays.

"The public whom you are serving as a public utility," said he recently to a friend in the electric light business, "can tell you a whole lot about your company that you do not know and would be glad to hear, and one way to get its co-operation is to be open and above board. Be ready to meet your customers and the public more than half way."

And Mr. Tait practices what he talks. In a matter, of days gone by, between the public and his company, the adjustment of some differences was made by Mr. Tait, much to the advantage of patrons, when matters might just as well have been decided the other way. Dayton papers in comment suggested on their editorial pages that presidents of other public service companies might do well to follow the example of President Tait in their dealings with the public. The following morning queries came by telephone asking, in a joking way, what the cost of such excellent newspaper publicity had been and the explanation that the effort had been to settle the difficulties justly, and that Mr. Tait had nothing whatever to do with the favorable publicity, would hardly suffice except to those who knew the man.

"Our men," says Mr. Tait, "are instructed to give the consumer who enters a complaint about an overcharge on a small bill just the same care and attention as is shown the consumer whose bills run into the hundreds. If we receive a hurry call to make repairs for a customer, our men are expected to use the same haste in getting there and doing the work as they would were the breakdown on their own premises.

"Even our telephone girls are chosen from the viewpoint that the public appreciates the operator with the pleasing voice and accommodating manner."

That Mr. Tait has not only built up a prosperous and highly efficient system and made Dayton a model, electrically, for the scores of rapidly growing middle sized cities all over the country to emulate, but at the same time has secured to a remarkable degree the good will and co-operation of his public, are probably factors which led the National Electric Light Association to seek him out and bestow upon him their highest office. He was elected the twenty-sixth president of the Association at the Seattle convention last June.

Mr. Tait was born in Catasauqua, Lehigh County, Pennsylvania, in 1874. Following a school course he became a telegraph operator, assistant train dispatcher and then accepted a position as night engineer of the Catasauqua Rolling Mills' lighting plant.

He next became secretary to the president of the Davis & Thomas Company, of Catasauqua, and thus acquired experience as to the use of structural iron.

In 1894, when only 20 years old, he began his central station career by becoming manager of the Catasauqua Electric Light & Power Company. Not long afterward a consolidation was effected with the local gas interests, and Mr. Tait directed the Catasauqua Gas & Electric Company until 1899. He then became connected with the public utilities of Somerville, N. J., and rebuilt all of the plants at that place, merged under the name of the Somerset Lighting Company. New London, Conn., was the next scene of his labors and he took charge of the gas and electric properties there as well as of a general machine and repair shop, developing the corporation now known as the New London Gas & Electric Company.

In 1905 Mr. Tait moved to Dayton, Ohio, to direct the affairs of the Dayton Electric Light Company, representing the interests of Mr. A. M. Young and Mr. A. N. Brady, of New York City. The company is now known as the Dayton Power and Light Company. In addition to being the president and manager of this company Mr. Tait is vice-president of the Xenia Gas and Electric Company of Xenia, Ohio.

Mr. Tait is a member of the American Institute of Electrical Engineers, of the Illuminating Engineering Society and of the American Gas Institute. He is also a member of the Country, City and Automobile clubs of Dayton, and the Engineers' Club of New York City.

The Price of One Cigar

The cartoon presented herewith represents graphically what ten cents worth of electricity a day—the price of one cigar—will do for the householder. The pictures on the left show the old way of doing things, while those on the right show the comforts and conveniences in the home which may be had for the price of even one cigar. After all, why not smoke a pipe? It's more comforting, and a little Havana smoke would pay for a lot of kilowatt hours of current.

Electrical Interests of Women

EDITED BY GRACE T. HADLEY

Sonnenberg

Sonnenberg is a magnificent estate on the upper edge of Canandaigua, New York. Twice each month during the summer the grounds are open to the public and it is estimated that 10,000 people visited the place on one day last August. The estate comprises some 300 acres, and about 75 acres are within walls.

Beginning at the main entrance, electricity plays an important part in the illumination of the gardens. The two lights at the great iron gateway are monster tungsten lamps. Along the pathway leading to the Japanese Garden are stone lanterns on pedestals, modeled after the Oriental pagoda, each equipped with eight candlepower cluster lights. The Japanese Garden is an exact reproduction of an Oriental garden with dwarf trees, miniature cascade, lily ponds, bronze idol and exquisite Japanese house, all delightfully arranged.

The Italian Garden is beautiful with a classic fountain, marble pavilion, sunken gardens and pergolas. The pergolas have electric lamps set in the beams and covered with a crystal, while the pavilions have corner cluster lights.

By night the gardens may be beautifully illuminated and the power is furnished from Niagara Falls.

The estate is the property of Mrs. F. F. Thompson of New York, and Sonnenberg is her summer home. On days when the grounds are open, hundreds of people motor from distant cities to visit these famous gardens.

THE MAIN ENTRANCE TO SONNENBERG

A Marshmallow Roast

A marshmallow roast appeals to every woman with a sweet tooth. An electric toaster stove affords the safest and most convenient method of preparing such a feast. Nearly every one remembers the burned fingers or flushed face one always acquired trying to brown the marshmallows before an open fire, but with an electric stove there are no burned fingers. Here the heat is localized, and this is a great advantage. Instead of sending a goodly proportion of the heat into the room, all the heat is concentrated, leaving the surrounding atmosphere cool and pleasant.

AN APPEAL TO THE WOMAN WITH A SWEET TOOTH

Fudge may also be just as easily made on the electric toaster stove. Boil one cup of milk and two cups sugar in a saucepan placed directly on the toaster stove heater. Add two squares grated chocolate or five tablespoons cocoa and boil until a few drops of the mixture will harden in water. Turn off the current, add a tablespoon of butter, and flavor with vanilla. Then beat until the fudge begins to sugar and pour out into a buttered pan. Mark into squares.

Marketing by Telephone

Go into a grocery store and see the women there plodding about among the foods, sweeping up the floor with their skirts that but recently were dragged along the streets. Watch them fingering, smelling and tasting, worrying and puzzling over what to buy and what not, and then ask yourself if the home method of shopping over the telephone is not the saner.

The telephonic marketer can take her choice of the places at which she may care to trade. She may go near or far, to a big store or the little store. She may trade in the heart of the business district just as handily as at the corner grocer's.

A girl at a telephone can take down more orders in five minutes than a clerk can secure in an hour. Think of the time, trouble and clerk hire this saves, to say nothing of the protection of the grocer's stock. One sampling, curious woman can finger more profits off a stock of produce than can be made up in a

dozen sales. A telephone in a grocery store, meat market or shop of any kind is worth half a dozen ordinary clerks.

Electric Milk Warmer

It doesn't take an electric milk warmer long to win favor with mothers. No flame, no soot, no odor—nothing but heat, and that is all on the inside. How much better, how much easier, than going to the stove and lighting a fire! The Westinghouse warmer is an absolutely safe utensil to use at the bedside. It is also good for many other purposes. It will boil a pint of water in six minutes. It is very convenient when you need hotter water than you can get from the faucet.

CLEAN ELECTRIC HEAT—NO FLAME OR SOOT

Do You Believe in Signs?

"I would like to give a Hallowe'en party," ventured little Mrs. Watson timidly. "The Jack o' Lanterns are such fun and now that the house has been wired, I think I could manage some unique effects in illumination."

"Um-m-m," remarked her husband, immersed in the morning paper. He did not mean to be discourteous, but he was always absorbed in business or deep in the political news of the day.

"And there's something else on my mind," said Mrs. Watson, plucking up courage. "The gas range is acting up very badly and if I can't have another range just yet, I wish I could have some of those lovely electric utensils I saw in a window down town. A chafing dish would help me out Sunday evening with the tea, and a toaster would be fine for breakfast, or, better still, a toaster stove—"

Mr. Watson jumped up from the table, hastily kissed his enthusiastic little wife, and hurried out of the room, with her wistful words ringing in his ears.

"Seems like women are always thinking of something nowadays and never contented with what they have," he grumbled. "Time was when they cooked in a fireplace with a single iron pot, but now—" a passing street car absorbed him and the balance of the thought.

When the car stopped down town, and Mr. Watson alighted, he found himself almost directly in front of a most attractive window. Just at the psychological moment there flashed across his troubled vision these words:

DO YOU BELIEVE IN SIGNS?

There it was winking at him from the window in little electric letters of fire and below flashed another sign:

COOK WITH ELECTRICITY

Mr. Watson hurried on, but all day in the office the little letters of fire winked at him surreptitiously from musty law books, and the wistful words of his wife rang in his ears persistently.

The next morning he deliberately paused before the attractive window and studied the contents.

"It does beat all, what they do get up nowadays," muttered Mr. Watson. "I wonder what they are for. I believe—

DO YOU BELIEVE IN SIGNS?

The little illuminated sign flashed and winked at him, until he hurried away.

The third morning he paused before the window again, not that he intended to buy, oh, no, but somehow, the saucy signs had caught his eye—

GOOD MORNING!

COOK WITH ELECTRICITY

That was the way the sign talked day after day. On the fifth day Mr. Watson walked into the store, just to look around. Not that he intended to buy—

That evening when he went home there was a bulky parcel under one arm. When Mrs. Watson opened it, she found a toaster stove with cord and switch.

"How did it ever happen," she cried, giving the donor a hug. "What made you think of it?"

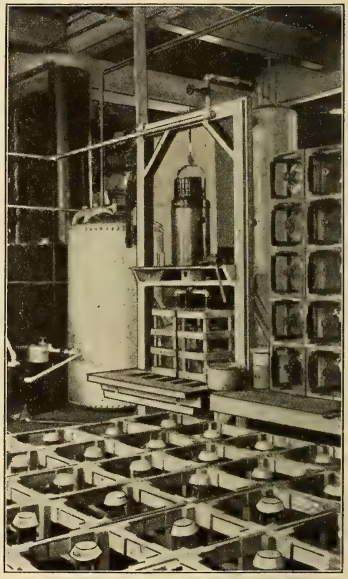
"I really can't account for it," laughed her husband, "unless it means that I have come to believe in signs."

The Cut-out Switch

Many of the new electric utensils are equipped with a cut-out switch. If the utensil is attached to an overhead electric light socket, this switch obviates the necessity of reaching up to turn off the current or pulling the plug from the utensil. The on-and-off switch is used on the one-heat utensils, but the three-heat utensils must have a regular cut-out switch made especially for the utensil.

Sterilization of Drinking Water by the Violet Ray

A plant for the sterilization of 150 gallons per hour of Lake Michigan water by violet rays is in operation in Chicago. The water is used to supply water coolers for drinking purposes in office buildings and homes. The process consists of coagulation, sedimentation, double filtration and sterilization by violet rays. These rays are emitted from a Cooper-Hewitt quartz tube mercury



WATER STERILIZING PLANT

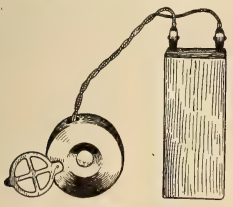
vapor lamp. The ordinary small size lamp is enclosed in a cylindrical case. The glass globe ordinarily used to cut out the violet rays is omitted and a five gallon copper cylinder is substituted. The best results are obtained when the mercury vapor tube is placed two and a half inches above the surface of the water.

Water from the city mains enters a closed settling tank, receives a small dose of coagulant and is given several hours' sedimentation. It then enters a second filter and received a one-half dose of coagulant. The water then enters the top of an ordinary galvanized iron 60 gallon tank open to the atmosphere and passes out at the bottom to the sterilizer. As long as the filter delivers a perfectly clear effluent, perfect sterilization is practically effected.

Another sanitary precaution consists of periodic cleansing and sterilization of the porcelain jar by a portable violet ray lamp which is carried from office to office, or home to home, and adjusted over the jar for five minutes, while connection is made to an electric light socket. The system has been approved by the Chicago Board of Health, after a thorough test.

The Flexilyte Lamp

The new Flexilyte for automobile users is a portable extension light in which the cord may be pulled out to any desired length and wound up again inside the case after using. Camping parties will find the Flexilyte just the



FLEXILYTE LAMP

thing for lighting the shack or tent from the automobile batteries. When touring, it can be used to illuminate guide posts, study maps by, or, if you drop something in the road, you can put a little battery into your pocket and carry the light as far as you like. A sudden shower that catches you en route will not throw the car in gloom if you have a Flexilyte to hang up on the top and cheer the occupants of the machine.

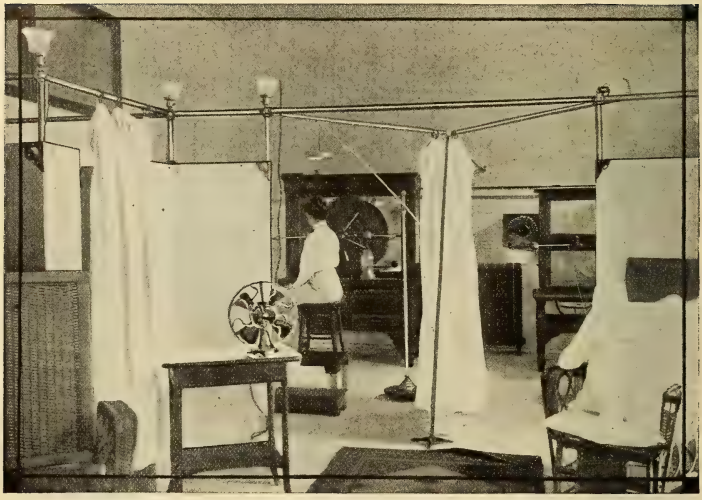
The flexible cord winds up inside the casing on the same principle as a tape measure. With a suitable plug attachment in place of the clips on the end of the cord, the light is very convenient in the house. Mothers feel perfectly safe with a Flexilyte in the nursery, for there is no danger of fire even if it is upset or dropped on the floor. Artists can hang the light over the easel or set it up on the drawing board. Amateur photographers use it with a red bulb for developing.

Electricity and the "New Attitude" Toward Disease

Modern medicine seeks to study and to know the methods by which nature fights disease and endeavors to overcome it. When Pasteur made the discovery that many serious ailments are transmitted by means of microbes it became apparent that it was of the greatest importance to prevent such maladies from gaining a foothold, or, better still, to prevent them entirely. Hence has arisen what has been well termed, "the new attitude toward disease." The old time healing art has become the "art of preventing disease" or the "art of maintaining health."

In addition to the valuable vaccines and antitoxins which check the ravages of certain dread diseases, a new and potent factor is proving its great efficacy as an agent in helping nature to fight disease. Electrical forces and animal serums and extracts are the remedies for the future in fighting diseases now called incurable. Electricity is the most flexible, controllable and convertible form of energy known, consequently it is frequently used as the medium for the production of other forms of energy that have been found valuable in therapeutics.

In a great many of the sanitariums where the "new attitude" takes definite form, electricity plays an important part in diagnostic, preventive and curative measures. An excellent example is the



ENJOYING A "STATIC BREEZE" IN THE ELECTRIC TREATMENT ROOM

one at Clifton Springs, N. Y. The electric treatment room is a model in the line of complete equipment for electro-therapeutics. Two static machines, high frequency apparatus, the electric light cabinet, the sinusoidal currents, the X-Ray, the blue light, galvanic and faradic battery, the motor driven vibrator, are all to be found here. The therapeutic lamp and massage vibrator are both widely known and used in the medical profession in the prevention and cure of diseased conditions.

The sinusoidal current is a comparatively recent innovation in medicine and it is doing wonderful work in deep seated conditions, especially where internal medicine is not so successful. This current is applicable where the large heavy muscles are dormant; that is, the involuntary muscles.

The latest development of the electric current for medical purposes is the use of high frequency currents. The discovery of the curative properties of these currents is due to the work of Dr. D'Arsonval, a French physician. His discoveries in this line are of such importance that he has been called the "father of high frequency." It is the conviction of many who have used these currents that they are destined to be as indispensable in the cure of stubborn chronic diseases as is the X-ray in diagnosis.

It is of interest to see just how the electric current acts on arterial diseases because there is a well known dictum in medical circles that "a person is as old as his arteries." Hypertension, or arterial tension above the normal, varying with individual characteristics and habits of life, is noted to precede structural changes, and a study of the averages shows that with advancing years the changes become more marked and resisting; that, is there is more resistance in the circulatory channels.

The symptoms present in this disease are certain poisonous conditions, increased internal resistance, high blood pressure, solidified lime deposits, dilata-

tion of the arteries, faulty elimination of carbon dioxide and the constructive process of tissue building is hampered.

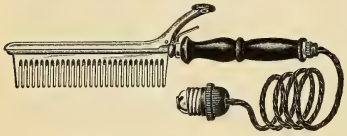
Now consider the action of high frequency auto-condensation current on such conditions: First, it has a more powerful action on all forms of germ life than any other form of electricity; the high frequency current, by reason of the enormous number of oscillations per second (considerably over one million) causes the blood corpuscles to alternately contract and relax in such a way as to create a molecular massage, this massage having a tendency to lower the increased resistance very materially; the use of a blood pressure apparatus before and after treatment shows the fall of pressure; numerous experiments have proved that the high frequency current has the property of dissolving lime substance, so the current would naturally have the same effect on the lime deposit which has attached itself to the arterial walls; as this lime deposit is dissolved and the blood pressure lowered, the arterial walls regain their normal diameter and elasticity.

ROAST YOUNG PIG

It is interesting to contrast the primitive cooking operations shown above with those of the modern kitchen in our own country. Roast pig as prepared by Philippine women may possibly taste just as well (to the natives) as if it were prepared in the most modern electric range or fireless cooker. But it seems to require the attention of several members of the family to turn the unwieldly spit and to look on with hungry glances while the slowly swelling pig revolves above the smoking coals. Neither can this process be considered as embodying the principle of localized application of heat, which is so effectually employed in electric cooking, for in this case most of the energy goes into heating up a half acre lot, and a very little into the pig.

Electric Comb for Drying Hair

The new Pelouze electric comb is a device appreciated by the ladies for quickly drying the hair after shampooing. The comb is part of a curling iron, the latter being ready for use by removing the comb. The heater and cord are made to revolve together so that the cord does not kink while in use. The temperature is so regulated in the heater that it will not burn the hair. The comb may also be had without the curling iron or the curling iron may be purchased without the comb attachment.



COMBINED COMB AND CURLING IRON

Hints for Using a Toast Stove

COUNTRY FRIED HAM

Use the toaster stove plate turned upside down so as to form a tray. Turn on the current and allow the toaster stove to stand until the tray becomes very hot.

Put in thin slices of raw or boiled ham and turn frequently. When nearly done, sprinkle with pepper and pour a half teaspoonful of water on each slice.

LAMB CHOPS

Use the toaster stove plate turned upside down so as to form a tray. Turn on the current and allow the toaster stove to stand about four minutes so that the tray becomes very hot.

Put in the chops and sear both sides quickly; turn them frequently as they cook. Just before serving, butter, salt and pepper them.

GRILLED SWEET POTATOES

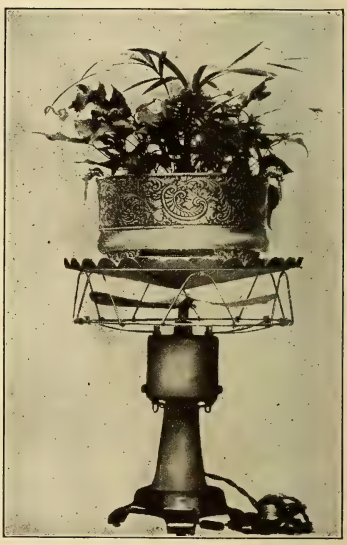
Use the plate of the toaster stove turned upside down so as to form a tray. Turn on the current, and when the tray becomes hot, butter it and drop in large thin slices of cold boiled sweet potatoes.

Turn the slices occasionally and cook until nicely browned. When nearly finished, sprinkle with sugar.

Table Fan with Fern Dish

A novel and artistic design of electric table fan is seen in the accompanying illustration, so constructed that all parts of the table and room receive an equal distribution of air. The deflector causes a continuous direct breeze on all sides, this result being impossible to achieve with any other form of electric fan.

This device is most efficient in its operation and the deflecting plate forms a convenient stand for a fern dish or flowers. The entire equipment is an ornament to the table, being beautifully finished in polished nickel and dull satin jet. A silk cord conducts the current from the plug of an ordinary lamp socket to the universal electric motor.



FAN AND FERN DISH COMBINATION

Junior Section

An Interesting Trick with Static

An interesting trick with static electricity, which is puzzling even to those well versed in static, can be performed in the following way: Take a saucer and fill it half full of water, and then get some fine dust such as collects on shelves, etc., and put it in the saucer so that it will float on the water; then rub the end of your finger on your hair and dip it into the water, and you will notice the dust will all keep away from your finger. Then dip the finger of your other hand, without rubbing it on your hair, and you will notice that the dust will not keep away as before.

By not telling the spectators that you must first rub your finger on your hair, and have them try it, will of course cause no end of wonder. The theory of this is easily explained, as two bodies containing a static charge of the same kind will repel each other, in this case the finger repelling the dust.—CHARLES OLSSON.

Model Electrically Driven Shop

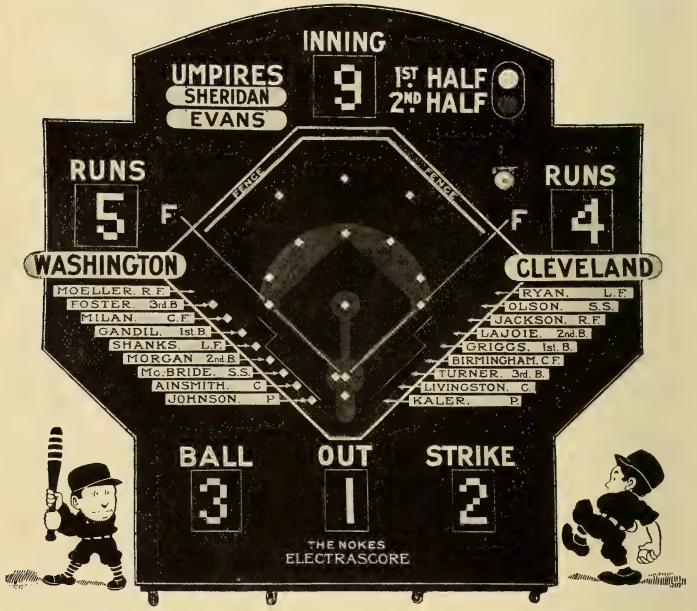
The Narragansett Electric Lighting Company of Providence, R. I., has on exhibition in its offices a model motor driven shop. The purpose of the exhibit is to advertise the company's facilities, for installing and operating electric motors. The two story model is six feet long and three feet high and in miniature are shown a pattern shop, machine shop, office, drafting room and electric elevator. All details even to workbenches, office fittings, small electric lights and anti-spitting signs are presented. The miniature tools, 20 in number, are motor driven. With the exhibit is a neatly prepared and framed statement recording the fact that the company has over 18,000 horsepower in motors in service.

MODEL ELECTRICALLY DRIVEN SHOP

The Electrascore

Prof. R. A. Nokes has put another invention on the market and in the light of its usefulness to the baseball fan it has at once struck public favor. This is the Nokes Electrascore, which has been successfully demonstrated and exhibited in reporting public games.

The board is 16 by 16 feet, with figures are electric; those for the innings, balls, outs, and strikes being fourteen inches tall and the solid circle of illumination for the first and second halves of the innings having a diameter of six inches. The names of the players, arranged on either side of the field below the city they represent, are in black letters on portable white slats, which are inserted in grooves, easily adjustable.



THE ELECTRASCORE, LATEST BASEBALL SCORE BOARD FOR THEATERS

ures, names of players and their respective assignments, names of contesting organizations, etc., of such size that they can be plainly read from any part of a theater. The actual field is of a strong wire screening, painted green, with the diamond broadly outlined in terra cotta. Beyond this the board is black with ample space for the various plays of the game in white lettering. All movable

From these radiate white arrows towards the field where stand, on the screening, the electric men, so to speak, in the form of white lights three inches square.

It is the field itself that is the most fascinating and, with its skillful arrangement of lights, the most unique. Beneath that screening is a network of more than a thousand lights of varying colors and thousands of feet of wire.

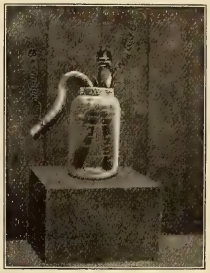
The chief advantage that the Electrascore has over other electric score boards is that every play or movement of ball or man is shown in actual running operation in all detail, not merely the final result. For instance, after the men are stationed at their various places in the field, each man of the opposing organization walks, as a white light, from opposite his name along the diamond to the bat in a rather human like manner. Then, as the player proceeds about the field in runs, etc., he assumes a green color of the same size, being thus readily distinguished from the white light men of the bases, etc., and the red light ball.

The ball, a red square light three inches square, moves along the field in a continuous line from every man handling it, its course from pitcher to batter being particularly well designated as to balls and strikes, also its movements upon the field. When a man has completed his play he assumes a white light and proceeds back to his place beside his name. Nor do the men at the bases remain stationary or merely disappear. They scramble about after the ball or men in a most interesting manner. Even the consultation of one player with another is recorded on the Electrascore. No movement whatever is lost. It was this very detail that Prof. Nokes was desirous of securing and it is this very feature that marks the essential difference with other score boards.

The Electrascore contains 1,500 lights, 23,000 feet of wire and has a weight of a ton. It is built primarily for a theater show, though it can be used in the open if desired. The rear of the exhibition board is a harmonious collection of electric wires, cutoffs, contacts, levers, stops, etc., for manipulating the different plays and players of the game. Here is also a small copper table, a counterpart of the large display board, on which all movements are made by electric contact as received by wire from the city of action and thence transmitted to the board viewed by the audience.

Lead Pipe Storage Battery

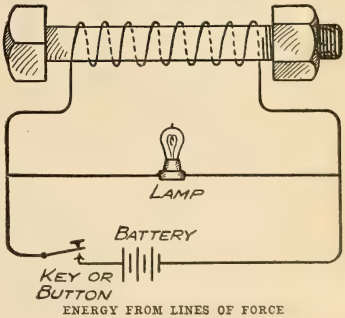
One morning the plumber came to our house to do some lead work with the water pipes. He gave me about two feet of half inch lead pipe. I cut the pipe in two and placed the ends in a Mason quart jar, separating the two pieces of pipe by a small piece of wood. I then connected wires to each, and filled the jar with ten parts of water to one part of sulphuric acid. The battery was then charged for a day by my eight volt, half ampere dynamo. The battery proved so efficient that I used it for our front door electric bell. —J. W. Quimby.



LEAD PIPE STORAGE BATTERY

Energy from the Lines of Force

An interesting experiment may be performed with apparatus connected up as in the diagram. Wind two layers of No. 18 insulated copper wire around a large iron bolt. Connect a two-volt lamp as shown. Press the key and the lamp brightens up, then takes on a steady

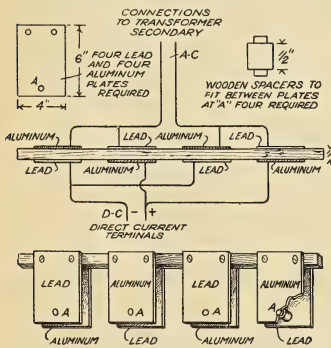


ENERGY FROM LINES OF FORCE

glow. Open the key and the lamp brightens and burns for a moment before going out. This effect is due to the lines of force in the bolt and coil which at the start are built up and which later send energy into the lamp as the key is opened and the lines die out.—Rowland G. Hazard.

Rectifier

For the operation of shunt wound motors, spark coils for plating, and for charging storage cells, direct current is required. For such service, an electrolytic rectifier may be very easily constructed. A number of concerns furnish the aluminum and lead plates ready for use. Narrow glass receiving jars set in a row and properly spaced hold a solution



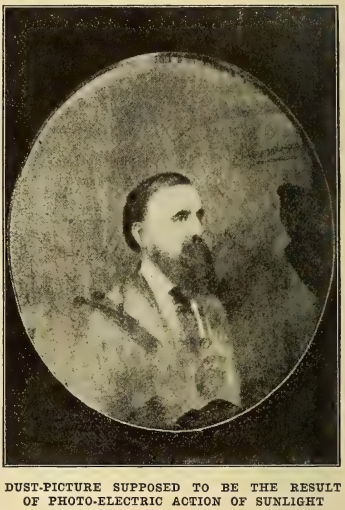
PARTS OF AN ALTERNATING CURRENT RECTIFIER

of sodium phosphate. A teaspoonful of sulphuric acid is added to each jar of the liquid.

The connections for a four cell set to a 110 volt alternating current circuit are shown in the drawing. When first connected, the rectifier may not operate properly. A sort of "forming" process must be gone through with. This may require but five minutes, and possibly in some other cases an hour.—W. G. Paulson.

Dust Pictures

One of the properties of light is its negative atoms of electricity and their ability to produce an electric current under certain conditions. When light falls



DUST-PICTURE SUPPOSED TO BE THE RESULT OF PHOTO-ELECTRIC ACTION OF SUNLIGHT

on a zinc plate, for instance, very small charges of electricity—electrons—escape from the plate. The departure of these little particles results in the plate becoming positively charged. Ultra-violet or photo-chemical rays are in general more active than visible rays of light. This phenomenon is known as the photo-electric effect.

It is highly probable that the photograph reproduced herewith represents one of the interesting results of the photo-electric effects of sunlight. This half-tone was made from a photograph of a "dust-picture" discovered by William J. Hammer a number of years ago A picture which had hung in a frame for eight years was being removed from its frame, when a faint dust-picture was discovered on the glass. The glass had been quite

close to the picture, but not quite in contact. After some difficulty, the faint dust-picture was successfully photographed. The lighter portions of the half-tone represent dust, while the darker portions are due to less or no dust. The irregularities and scratches are due to finger-marks on the dust-picture, made when the glass was being removed from the frame.

The dust-picture is supposed to be the result of the photo-electric action of sunlight. The charged electrons which are expelled from the silver and silver compounds in the original photograph very likely carry dust to the glass. Other dust-pictures have been discovered and no doubt many have been unknowingly destroyed.

Indian Boys Advertise Electricity

W. C. Duncan, manager of the New Business Department of the Lawrence (Kan.) Railway and Light Company, sends us the accompanying picture of an effective advertising scheme employed by the company. A band composed of 36 Indian boys, who attend Haskell Institute, in Lawrence, was taken over the entire system in a special car. People all along the route were called to their front doors by the music and of course could not help but read the large signs carried on each side of the car, all of which was calculated to impress upon them the fact that their city had an up to date, hustling electric company.

INDIAN BAND ADVERTISING ELECTRIC COMPANY

"Drop in a Good One, Please"

Joe and Wesley were slick ducks and were proud of it. They didn't live in the country. They were wise guys and game sports. They wore checked shirts and red ties, and each had a cigarette tilted

upward in his mouth. They stepped into a telephone booth and Joe called "Main 4-9-7-2." Presently the operator said, "Drop in a nickel, please."

"Say, Wes," suggested Joe, feeling in his pocket, "here's a good chance to work off that plugged nickel."

Wes dropped the plugged nickel. The bell rang clear enough, but no answer came over the line—nothing except the operator's pleasant voice, saying, "That nickel was plugged. Drop in a good one, please." Joe gasped, then dropped in a good nickel and had his talk.

"Say, Wes," he whispered, as they left the booth, "do you reckon that gal could see the plug in that nickel all the way from the exchange.

Federal Wireless Station at Central Point, Ore.

By P. J. O'GARA

The Federal Telegraph Company of San Francisco, Calif., now has in operation a wireless station at Central Point, Oregon, which is approximately midway between Portland and San Francisco. This station is a part of the system which connects the most northerly points with the southern points on the Pacific Coast, and is one of the fourteen stations now in operation.

The Federal Wireless Company is one of the three companies making use of the Poulsen system. The other companies are the Continental syndicate, which is working the European continent; the other is an English and Canadian company, later taken over by Danish capital. The Federal Telegraph Company has acquired the exclusive rights for the United States, Alaska, Cuba, Panama, Porto Rico, Hawaiian Islands and the Philippine Islands, as well as the foreign rights of Poulsen, of Copenhagen. The company's laboratories are at Palo Alto, Calif.

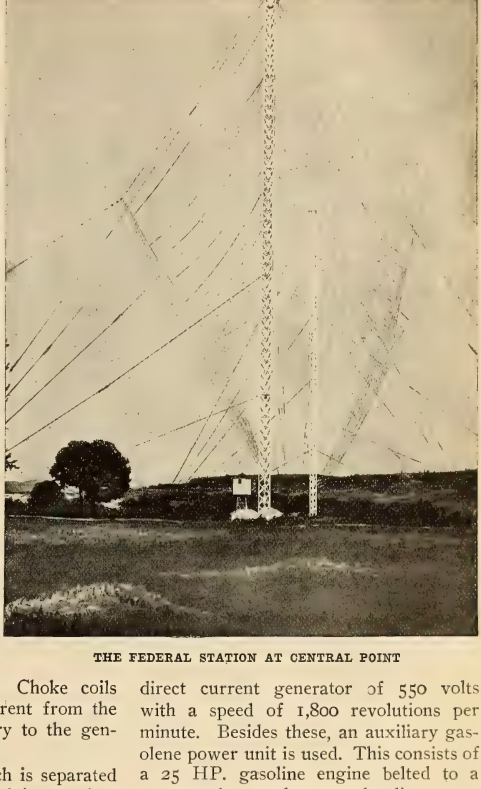
The new station in Southern Oregon was erected at an approximate cost of $50,000. It is situated on the floor of the Rogue River Valley at an approximate elevation of 1,275 feet, with the surrounding country rising to elevations of between 6,000 and 7,000 feet. The station is, therefore, situated in a depression of about 4,700 to 5,700 feet, the distance from the station to the surrounding elevated country being all the way from 25 to 30 miles. However, no difficulty has been encountered on account of the topographical features surrounding the station.

The towers supporting the antenna are of select fir. They are triangular in form, stand upon solid concrete foundations, are firmly braced and trussed, and rise to a height of 304 feet, their distance apart being 550 feet. Heavy cables properly insulated so as to prevent absorption of energy keep the towers perpendicular and take up the strain of the two heavy messenger cables supporting the directional antenna, which is of the umbrella type. The messenger cables are insulated by large bell shaped insulators, and approximately 36,000 feet of seven strand No. 18 phosphor bronze wire are suspended from them, passing over two insulated cables known as the "frame," and finally to heavy copper ribbons which are insulated from low towers midway between the main towers and just outside the instrument house. The two parts of the antenna coming down from the frame to the copper ribbons do not look unlike two large fans. A single broad ribbon of copper passes through a heavy porcelain insulator through the wall of the building, and is there connected with the instruments. As the two towers stand in an east and west line, it will be seen that the antenna has a certain directional effect; the purpose being to work with stations to the north and south.

The ground connection is such as to be absolutely reliable. At the bottom of each pit, which was dug for the purpose of placing the tower foundations, a large copper plate was placed. Besides, several trenches, radiating in every direction from the operating station, were dug

approximately two feet deep, and in them were laid a number of strands of copper wire, totalling several thousand feet.

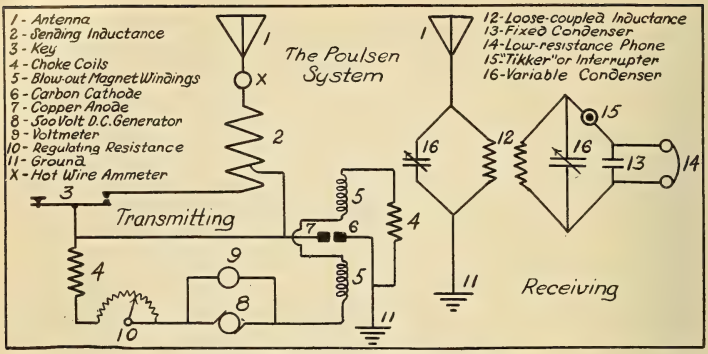
All the apparatus used is of the Poulsen type. The station is rated at 12½ KW, but may develop fully fifteen KW. The apparatus for sending generates a 500 volt direct current arc between a copper anode and a carbon cathode in an atmosphere of hydrocarbon gas. Alcohol vapor generated by a small electric heater and fed through a tube to the arc chamber is the gas used. The copper anode and arc chamber are cooled by water circulation, which is started automatically when the arc is struck. The arc is burned in a strong magnetic field produced by large electric magnets in series with it. The arc is self striking by action of the "blow-out" magnets on closing the direct current circuit for sending. Choke coils keep the surge of the current from the line, thus preventing injury to the generator.



THE FEDERAL STATION AT CENTRAL POINT

The power station, which is separated from the sending and receiving station, has two motor generator sets which take current from the Oregon-California Electric Power Company's lines. The motor generator sets are of two types, one being a 20 HP, three phase, 60 cycle, induction motor direct connected to a 12½ KW, direct current, compound wound generator of 550 volts, with a speed of 1,250 revolutions per minute; the other consists of a 20 HP, three phase, 60 cycle, induction motor direct connected to a shunt wound, 12½ KW, direct current generator of 550 volts with a speed of 1,800 revolutions per minute. Besides these, an auxiliary gasolene power unit is used. This consists of a 25 HP. gasoline engine belted to a compound wound, 550 volt, direct current generator of 12½ KW capacity. The engine speed is 300 revolutions per minute.

The layout is such that the three generating sets are connected to a switchboard which is supplied with a watt meter, volt meter and ammeter. Another switchboard of practically the same type is placed in the operating station. The compound wound direct current generators seem to be more efficient than the shunt wound.



HOOK-UP OF THE POULSEN WIRELESS SYSTEM

The interior of a Federal wireless station is more or less a puzzle to the amateur who understands the spark system. Although the Poulsen apparatus appears to be complex, it is, after all, very simple in operation. The Poulsen system is merely an improvement on Duddell's "singing arc," and consists mainly in the replacing of one of the carbon electrodes with one of copper, and burning the arc in a strong magnetic field which is surrounded with a hydrocarbon gas, such as alcohol vapor or coal gas. This arrangement, with a condenser of small capacity, and a large inductance in series shunted around it, produces undamped oscillations of very high frequency, reaching from a few hundred thousand to more than a million. The voltage used to produce this arc is about 500 to 600 volts direct current. The copper anode is connected to the antenna through a large inductance, and the carbon electrode is direct connected to the earth. This forms the oscillation circuit. No condenser is used, although the condenser effect is nevertheless produced by the capacity of the antenna and earth. The Morse key is arranged to cut in a few more turns of inductance when it is held down, thus giving out waves of greater length. Sometimes a simple Morse key of the ordinary type is connected by a local battery to a sounder like instrument which acts as a relay in cutting in and out turns of the inductance. The long wave, which is known as the working wave, is given out when the key is depressed, and the short, or compensating wave, when the key is up. The Central Point station has a wave of approximately 3,000 meters in length. The new San Francisco station has a working wave of about 6,000 meters.

The receiving apparatus is very simple and unique. The antenna is connected to the earth through a variable condenser around which is shunted the primary of a loose coupled receiving transformer or inductance. The terminals of the secondary of the receiving transformer are connected through a "tikker" to a pair of low resistance phones which are in series with it. The two phones are shunted around a small fixed condenser, which is really in series with the tikker. Across the tikker and small condenser is shunted a variable condenser.

The tikker is merely an interrupter, and was invented by Pedersen, who was a colleague of Poulsen. In its first form it consisted of two cross wires in rapid vibration, which alternately make and break the circuit similar to the action of the vibrator of an induction coil. It is,

after all, nothing with an interrupter of special adjustment. The tikker now used is a small induction motor with a brass disk on one end of the motor shaft. This disk has a small groove around it in which a piece of spring wire runs as the disk turns. The disk is slotted transversely around its circumference in such a way that as it turns rapidly the wire spring running in the groove is caused to vibrate. The rate of vibration, or make and break, therefore, depends upon the speed of the motor shaft and the number of slots in the disk. The disk is connected to one side of the secondary of the loose coupled inductance and the vibrating spring to the other terminal, as described above. A very simple form of tikker is an ordinary telegraph relay connected through resistance to a 60 cycle alternating current. Although this would tend to heat the cores and coils of the relay, if kept in continued service, it will, nevertheless, operate quite efficiently as a tikker.

The operation of the receiving apparatus is as follows: The oscillations received through the antenna charge the variable condenser when the tikker is open. When it closes, the variable condenser discharges into the small condenser. Then when the tikker again opens, the small condenser discharges into the phones, causing the signals to be heard.

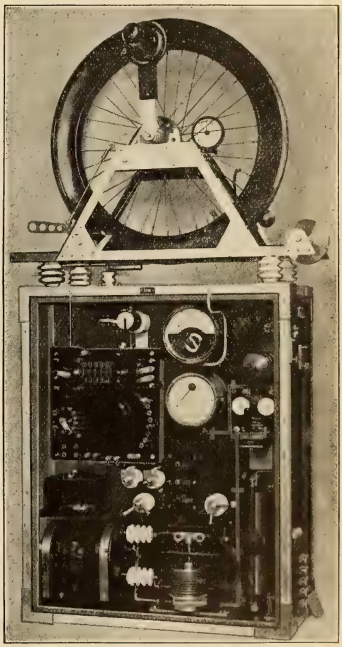
As will be seen, no detector is used. The reason why the ordinary detectors cannot be used is because the waves have too high a periodicity; this is why amateurs have noticed the peculiar frying noise which is made by the Poulsen arc.

The signals are read by the discharge of accumulated energy in the condensers, which accumulation takes place during intervals when the tikker is open.

The Poulsen system, by reason of using undamped waves, operates night and day with the same efficiency, sunlight seeming to have no effect on the transmission.

Wireless on German Airships

The Telefunken Company, of Berlin, Germany, has designed a special type of wireless station to be used on the big dirigible airships for which that country is noted, and which are in actual service,



AIR SHIP WIRELESS PLANT WITH REEL FOR LOWERING AERIAL

carrying passengers, principally sightseers, from one city to another.

In view of the necessarily limited dimensions of the cars, the whole outfit had to be reduced to as small a compass as possible, and was arranged in a cabinet subdivided by a vertical partition into an open front compartment and a closed back compartment. The front compartment contains such apparatus as

is operated by hand, whereas those parts which, like the self inductions, capacities, etc., require no supervision, are placed in the closed back compartment. On top of the cabinet is installed, on four porcelain insulators, a capstan carrying an aerial wire of phosphor bronze, about 650 feet in length. The terminals connected to the source of current are fitted on the right outside of the cabinet.

The phosphor bronze aerial wire is wound on the capstan, an insulated handle allowing the length corresponding to the actual wave length to be unwound and lowered beyond the railing of the car by means of conveniently arranged pulleys. A counter dial indicates the length of wire unwound.

An antenna switch installed in the cabinet allows the receiver to be locked during transmission, while in the receiving position the same is done with the source of current, thus eliminating any risk of disturbance.

The source of current is an alternating current machine directly coupled to its exciter; its output is about 500 watts, with a frequency of about 500 cycles per second. It is operated by the airship motor. A voltmeter, as well as the speed and tension regulators and the fuses, are installed in the interior of the car. The range of this equipment is between 60 and 120 miles, and the weight 275 pounds.

Alexander Wireless Bill

The Alexander wireless telegraph bill, which has been under consideration by the House of Representatives, was recently stricken from the calendar, and there is little probability that it will pass during the present session of Congress. Representative Mann objected to a consideration of the subject at this time on the ground that it requires more study and further consideration before taking final action. The government is said to be especially anxious to secure a broad law which will secure relief from interference with wireless communication by the numerous amateurs.

Electrolytic Interrupter

The interrupter described is not a new type, but one that can be used as a Wehnelt or a Simon-Caldwell. It will run on as small a current as two amperes. Used with an open core transformer or coil wound for 110 volts, it operates efficiently.

The materials needed are: Battery jar, 5 by 7 inches; two feet of ½ inch glass

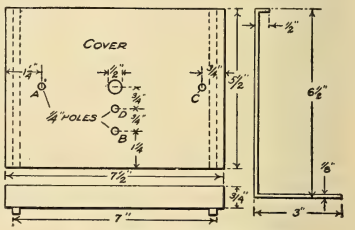


FIG. 1. COVER OF INTERRUPTER

tubing; three large binding posts; lead sheeting 2½ by about 10 inches; interrupter rod.

Square up a piece of oak ¾ by 5½ by 7½ inches. Bore a half inch hole in the center and four quarter inch holes, as

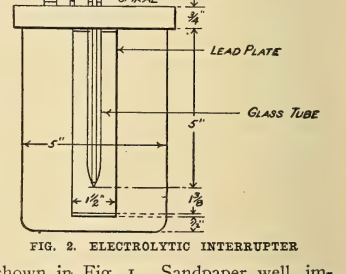


FIG. 2. ELECTROLYTIC INTERRUPTER

shown in Fig. 1. Sandpaper well, immerse in boiling paraffin for five minutes, and set aside to drip. Take the glass tubing and break off a piece seven inches long. Grasp both ends of the tube and place it in the flame of a Bunsen burner so as to heat a spot about 1½ inches

from one end. Turn it continuously until it changes to a reddish-yellow color, then remove quickly and pull apart. The tube will be drawn to a point at one end. Break this tapering end carefully until there is a hole large enough to allow the rod to slide through. Heat this end in

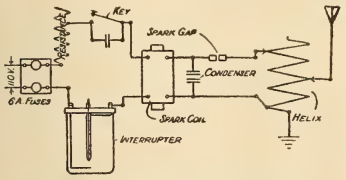


FIG. 3. CONNECTIONS OF INTERRUPTER

the flame until the hole begins to close and thicken. Remove from the flame and slide the rod into it. Only the very tip should project. Repeat the process until the hole is the right size. It is important that only a very little part of the point be exposed. Upon this depends the success of the interrupter. Take a three cornered file and file a hole in the tube about an inch and a half from the upper end. Take the lead sheeting, which should be at least ⅛ inch thick, and cut a piece an inch and a half by ten inches. Bore a quarter inch hole half an inch from one end, and bend as shown in Fig. 1.

Mount three binding posts in holes (A), (B) and (C), fastening the lead to (A). Tighten up binding posts (A) and (B) permanently, but leave (C) loose. Push the glass tube down through the (half inch) hole until its flared upper edge is flush with the top of the cover. Take a piece of No. 12 bare copper wire and twist it into a spiral around the interrupter rod so that the rod will slide through rather stiffly. Leave about three inches unwound. Put the rod all the way down into the tube and move the spiral until it is even with the groove of the movable part of the binding post (B), Fig. 2. Then take the unwound wire and twist it around the groove in the movable part of binding post (B) tight enough to keep it from wabbling and loose enough to let it turn easily. It may be necessary to cut off portions of the wire to get the right length to hold the rod in the center of the tube. Screwing the movable part up and down raises and lowers the rod in the tube.

Get a few inches of flexible lamp cord, scrape away the insulation at both ends and fasten one end to the No. 12 wire and bring the other down through hole (D) to binding post (C) and fasten it. See that the lead plate is about half an inch from the bottom of the jar. The tube should not be nearer than one and three-eighths inches of the lead plate at the end. Paint the bottom of the cover with hot paraffin in order to keep the screws and wires from corroding. Mix one part of sulphuric acid and nine parts of water, always pouring the acid into the water very slowly. Let this cool and pour into the jar.

Now put the cover in place, screw down the adjusting binding post tight and shove the rod down through the spiral as far as it will go. Screw up the binding post until the point of the rod is about a quarter of an inch above the hole. Connect the apparatus as shown in Fig. 3.

It is very advisable to have a resistance in series with the interrupter when trying it for the first time, in order to prevent the fuses from blowing if something is wrong. A good resistance consists of six 32 candlepower lamps connected in multiple. Before turning on the current, screw down the vibrator on the coil tight. Turn on the current. If everything has been done per instructions, a heavy flame should leap the gap. The interrupter is now running as a Simon-Caldwell. If desired, it may be made to run as a Wehnelt by screwing down the binding post until the point is exposed. A very heavy green spark will appear at the point of the rod. The interrupter should be placed in a vessel of cold water to keep it cool while in operation.—Fernand Pineoffs.

Questions and Answers in Wireless

By A. B. COLE

TUNING COILS.

76. *What is the purpose of a tuning coil?*

A tuning coil is used to vary the natural wave lengths of one or more circuits. A receiving tuning coil may be adjusted to give the one or more receiving circuits the same wave length as that of any particular transmitting station. A transmitting tuning coil, or sending helix, is employed to give the spark-gap-condenser circuit the same wave length as the aerial-ground circuit. Two circuits are in resonance when they have the same wave lengths, and it is then that the one will absorb a maximum of the energy radiated by the other. The receiving set will also respond to wave lengths corresponding to ¼ and other multiples of the wave length emitted by the transmitting set, but the received signals will be stronger when both are adjusted to the same wave length.

77. *Is a tuning coil necessary in a receiving station?*

A receiving tuning coil is not a necessity for receiving over short distances, for the signals are comparatively strong and force the aerial-ground circuit to assume their wave length. But for operation over longer distances the use of a tuning coil may increase the receiving radius 100 per cent or more.

78. *Upon what factors does the maximum wave length to which a tuning coil, connected to a given aerial, will naturally respond, depend?*

Inductance, capacity and resistance of the tuning coil and its associated circuits. The resistance of the tuning coil and of these circuits should be as small as possible, for its presence causes loss, probably in the form of heat, of the received energy.

79. *Upon what factors does the inductance of a tuning coil depend?*

Diameter and material of core, length of winding, number of convolutions of wire and space and insulation between adjacent convolutions.

80. *What is the best diameter of a tuning coil core?*

Increasing the diameter of the core increases the inductance; in fact, doubling the diameter approximately quadruples the inductance. It will be seen, therefore, that the inductance of a single convolution on a tuning coil of a diameter of five inches is about four times that of a single convolution on a similar tuning coil of 2½ inches diameter. For this reason the most accurate tuning may be obtained with a tuning coil of small diameter. When enameled wire is used the core diameter should not exceed two inches. If bare or double cotton covered wire is used, the core may be three inches in diameter.

81. *Are iron, brass or other electrical conductors suitable for tuning coil cores?*

No. A considerable loss of energy occurs in a tuning coil with such a core. This is probably due to eddy currents induced in the core by the oscillatory currents from the aerial system.

82. *Of what materials may the core be made?*

Cardboard, hard rubber, fiber, wood or almost any other non-conductor of electricity.

83. *I have wound a tuning coil on a wooden core. After two months the wire has become loose. What is the cause of this?*

Shrinkage of the core is a very common difficulty if the last three named materials mentioned in answer to question 82 are used for this purpose. They all contain a certain amount of moisture which evaporates in dry weather. If these materials are boiled for one hour in paraffine previous to winding on the wire, there will be no further difficulty.

The paraffine prevents both absorption and evaporation of moisture.

84. *How does the inductance vary with the length of the winding?*

The inductance varies directly as the length of the winding; that is, twice the length, twice the inductance, for we then have twice the number of convolutions of wire, upon which the inductance depends.

85. *Is the maximum wave length to which a tuning coil will respond equal to four times the length of wire on it?*

No. The inductance of a given length of wire wound in a coil is far greater than that of the same wire stretched in a straight line, due to the very fact that it is wound in a coil.

86. *May iron rods be used to support tuning coil sliders?*

Iron should not be employed for this purpose. The iron will complete the circuit of the magnetic lines of force generated by the coil and, from the fact that it is iron, will greatly increase the inductance of each convolution of the coil. Moreover, the passage of the lines of force through the iron will set up eddy currents in it, and loss of a portion of the received energy will result. Brass, through which but few of the magnetic lines of force will pass, is one of the best materials for slider rods.

87. *What is a straight coil tuner?*

A straight coil tuner consists of a non-conducting core, wound with a single, even layer of copper or other non-magnetic wire, in such a way that adjacent convolutions are separated from each other. Sliding contacts are generally provided so that any number of the convolutions may be used at will.

88. *What kind of insulation may the wire have?*

Enameled copper wire is the most generally used at the present time. Single silk or cotton covered copper wire is also employed to a less extent. Enameled wire has the advantage over the silk or cotton covered in that the insulation may be removed more easily so that the sliders may touch the wire. In winding with bare wire, a thread or another wire is generally wound on at the same time, so that adjacent convolutions will be separated, and after the wire is secured in place the thread is removed. Tuning coils of the same diameter have a greater length if wound with bare wire than if with enameled wire or silk or cotton covered wire, since the convolutions are spaced at a greater distance to make certain that they do not touch. A greater length is also necessary with a bare wire winding in order to obtain the same maximum inductance, on account of the distance between convolutions. One disadvantage of the bare wire winding is that if the core should shrink, even to a small extent, adjacent convolutions are almost certain to come into contact.

Carnegie Schools Wireless Station

The Carnegie Technical Schools of Pittsburgh, Pa., have joined the colony which own wireless plants of their own. The new station is almost entirely the product of the students. Messages can be sent from the institution for a distance of 200 miles and received from as far distant as 1,100 miles. Guy W. Fagan is president of the students' wireless club.

Directory of Wireless Clubs

This directory of amateur wireless clubs and associations will be published each month. When a new club is formed the names of the officers, also the street address of the secretary, should be forwarded to us at once. Any changes that should be made in the directory, when designated by an official of a club, will be made in the next issue after receipt of such advice.

Aerogram Club.—J. Stedman, President; A. Hayward Carr, Chairman Board of Directors; Albert S. Hayward, Treasurer; Donald P. Thurston, Secretary; Walter B. Clarke, 17 May St., Newport, R. I., Corresponding Secretary.

Aerograph Club of Richmond, Ind.—H. J. Trueblood, President; Richard Gatzek, Vice President; James Pardieck, 320 South 8th St., Richmond, Ind., Secretary.

Aero Wireless Club.—A. Garland, President; W. Ladley, Vice President; D. Beard, Napa, Calif., Secretary and Treasurer.

Allegheny County (Pa.) Wireless Association Arthur O. Davis, President; Theodore D. Richards, Vice President; James Seaman, Leetsdale, Pa., Secretary and Treasurer.

Alpha Wireless Association.—L. L. Martin, President; F. A. Schaeffer, Vice President; G. F. Girton, Box 57, Valparaiso, Ind., Secretary and Treasurer.

Amateur Wireless Association of Schenectady, N. Y. D. F. Crawford, President; I. Beebe,

Vice President; C. Wright, Treasurer; L. S. Uphoff, 122 Ave. "B," Schenectady, N. Y., Secretary.

Amateur Wireless Club of Geneva (N. Y.).—H. B. Graves, Jr., President; C. Hartman, Vice President; L. Reid, Treasurer; Benj. Merry, 148 William St., Geneva, N. Y., Secretary.

Arkansas Wireless Association.—G. A. Rauch, President; Edward Vaughn, 2622 State St., Little Rock Ark., Secretary and Treasurer.

Berkshire Wireless Club.—Warren A. Ford, President; William Yarkee, Vice President; Charles Bodecker, Treasurer; Jas. H. Ferguson, 18 Dean St., Adams, Mass., Secretary.

Canadian Central Wireless Club.—Alexander Polson, President; Stuart Scorer, Vice President; Benj. Lazarus, P. O. Box 1115, Winnipeg, Manitoba, Can., Secretary and Treasurer.

Cardinal Wireless Club.—K. Walthers, President; F. Dannenfelser, Vice President; Miss A. Peterson, South Division High School, Milwaukee, Wis., Secretary.

Chester Hill Wireless Club.—Waller Morgan, President; Richard D. Zucker, 46 Clinton Place, Mt. Vernon, N. Y., Secretary and Treasurer.

Chicago Wireless Association.—John Walters, Jr., President; E. J. Stien, Vice President; C. Stone, Treasurer; F. D. Northland, Secretary; R. P. Bradley, 4418 South Wabash Ave., Chicago, Ill., Corresponding Secretary.

Colorado Wireless Association.—William Cawley, President; Thomas Ekren, Vice President; W. F. Lapham, 1545 Milwaukee St., Denver, Colo., Secretary-Treasurer.

Custer Wireless Club.—Franklin Webber, President; Fred Cross, Vice President; Oakley Ashton, Treasurer; Walter Maynes, 438 Custer Ave., Los Angeles, Cal., Secretary.

De Kalb Radio-Transmission Association.—Bruce Lundberg, President; Walter Bergendorf, Vice-President; De Estin Snow, Treasurer; Bayard Clack, 205 Augusta Ave., De Kalb, Ill., Secretary.

Ekco Wireless Association.—Kenneth Hance, President; John Bathrick, Vice President; Earl C. Reineke, 518 9th St., Fargo, N. D., Secretary.

Forest Park School Wireless Club—W. S. Robinson, Jr., President; William Crawford, R. F. D. No. 1, Springfield, Mass., Secretary.

Frontier Wireless Club.—Chas. B. Coxhead, President; John D. Camp, Vice President; Franklin J. Kidd, Jr., Treasurer; Herbert M. Graves, 458 Potomac Ave., Buffalo, N. Y., Secretary.

Geneva Wireless Club.—Charles B. Hartman, President; Charles Smith, Vice-President; Benjamin Merry, Treasurer; Henry B. Graves, Jr., 448 Castle St., Geneva, N. Y., Secretary.

Gramercy Wireless Club.—James Platt, President; John Gebhard, Vice President; John Diehl, Treasurer; John Jordan, 219 East 23d St., New York, N. Y., Secretary.

Greenfield Wireless Association.—Edward M. Wolfe, President and Corresponding Secretary, 4125 Haldane St., Pittsburgh, Pa.

Hannibal (Mo.) Amateur Wireless Club.—Charles A. Cruickshank, President; J. C. Rowland, Vice President; William Youse, Treasurer; G. G. Owens, 1306 Hill St., Hannibal, Mo., Secretary.

Haverhill (Mass.) Wireless Association—Riedel G. Sprague, President; Charles Farrington, Vice President; Leon R. Westbrook, Haverhill, Mass., Secretary and Treasurer.

Hobart Wireless Association.—Asa Bullock, President; Charles Clifford, Hobart, Ind., Secretary.

Independence Wireless Association.—Boyce Miller, President; Ralph Elliott, Secretary; Joseph Mahan, 214 South Sixth St., Independence, Kan., Vice President.

Independent Wireless Transmission Co.—Harlan A. Eveleth, 72 Gray St., Arlington, Mass., Secretary.

Jonesville Wireless Association.—Frederic Wetmore, President; Webb Virmylia, Vice President; Richard Hawkins, Treasurer; Merritt Green, Lock Box 82, Jonesville, Mich., Secretary.

Lake View Wireless Club.—E. M. Fickett, President; R. Ludwig, Treasurer; R. F. Becker, 1439 Winona Ave., Chicago, Ill., Secretary.

Long Beach Radio Research Club.—Bernard Williams, 555 E. Seaside Bvd., Long Beach, Calif., Secretary.

Manchester, (N. H.) Radio Club.—Homer B. Lincoln, President; Clarence Campbell, Vice President; Elmer Cutts, Treasurer; Earle Freeman, 759 Pine St., Manchester, N. H., Secretary.

New Haven Wireless Association.—Roy E. Wilmot, President; Arthur P. Seeley, Vice President; Russell O'Connor, 27 Vernon St., New Haven, Conn., Secretary and Treasurer.

Northwestern Wireless Association of Chicago—Rolf Rolfson, President; H. Kunde, Treasurer; Edw. G. Egloff, 2729 Noble Ave., Chicago, Ill., Recording Secretary.

Oakland Wireless Club.—H. Montag, President; W. L. Walker, Treasurer; W. R. Sibbert, 916 Chester St., Oakland, Calif., Secretary.

Oklahoma State Wireless Association.—T. E. Reid, President; G. O. Sutton, Vice-President; Ralph Jones, Box 1448, Muskogee, Okla., Secretary and Treasurer.

Oregon State Wireless Association.—Charles Austin, President; Joyce Kelly, Recording Secretary; Edward Murray, Sergeant-at-Arms; Clareace Bischoff, Lents, Ore., Treasurer and Corresponding Secretary.

Peterboro Wireless Club.—G. B. Powell, President; C. V. Miller, Vice President; E. W. Oke, 263 Engleburn Ave., Peterboro, Ontario, Can., Secretary and Treasurer.

Plaza Wireless Club.—Paul Elliott, President; Myron Hanover, 156 E. 66th St., New York, N. Y., Secretary and Treasurer.

Pueblo Wireless Club.—L. R. Finke, President; B. C. Howe, Treasurer; K. G. Hermann, 100 Board of Trade, Pueblo, Colo., Secretary.

Rockland County (N. Y.) Wireless Association.—W. H. Crosby, President; Tracey Sherman, Vice President; Marquis Bryant, Secretary; Erskine Van Houten, 24 De Pew Ave., Nyack, N. Y., Corresponding Secretary.

Roslindale (Mass.) Wireless Association.—O. Gilus, President; E. T. McKay, Treasurer; Fred C. Ruth, 962 South St., Roslindale, Mass., Secretary.

Sacramento Wireless Signal Club.—E. Rackliff, President; J. Murray, Vice President; G. Banvard, Treasurer; W. E. Totten, 1524 "M" St., Sacramento, Cal., Secretary.

Santa Cruz Wireless Association.—Orville Johnson, President; Harold E. Sentor, 184 Walnut Ave., Santa Cruz, Calif., Secretary and Treasurer.

Southeastern Indiana Wireless Association—R. F. Yager, President; A. C. Cox, Vice President and Treasurer; H. Hitz, Fairmont, Madison, Ind., Corresponding Secretary.

Southern Wireless Association.—B. Oppenheim, President; P. Gernsbacher, 1435 Henry Clay Ave., New Orleans, La., Secretary and Treasurer.

Springfield (Mass.) Wireless Association.—A. C. Gravel, President; C. K. Seely, Vice President and Treasurer; D. W. Martenson, Secretary; Club Rooms, 323 King St., Springfield, Mass.

Spring Hill Amateur Wireless Association.—R. D. Tilley, President; P. Hood, 2nd, 2 Benton Road, Somerville, Mass., Secretary and Treasurer.

St. Paul Wireless Club.—Thos. Taylor, President; L. R. Moore, Vice President; E. C. Estes, Treasurer; R. H. Milton, 217 Dayton Ave., St. Paul, Minn., Secretary.

Tri-State Wireless Association.—C. B. DeLa-Hunt, President; O. F. Lyons, Vice President; T. J. M. Daly, Treasurer; C. J. Cowan, Memphis, Tenn., Secretary.

Waterbury Wireless Association.—Weston Jenks, President; Alfred Upham, Treasurer; H. M. Rogers, Jr., 26 Linden St., Waterbury, Conn., Secretary.

Wireless Association of British Columbia.—Clifford C. Watson, President; J. Arnott, Vice President; E. Kelly, Treasurer; H. J. Bothel, 300 Fourteenth Ave. E., Vancouver, B. C., Corresponding Secretary.

Wireless Association of Canada.—W. Fowler, President; E. G. Lunn, Vice President; W. C. Schuur, Secretary and Treasurer.

Wireless Association of Montana.—Roy Tysel, President; Elliot Gillie, Vice President; Harold Satter, 309 South Ohio St., Butte, Mont., Secretary.

Wireless Association of Savannah.—P. C. Bangs, President; A. A. Funk, Vice President; H. Jenkins, Treasurer; L. H. Cole, Cor. Liberty and Price Sts., Savannah, Ga., Secretary.

Wireless Club of Baltimore.—Harry Richards, President; William Pules, Vice President; Curtis Garret, Treasurer; Winters Jones, 728 North Monroe St. Baltimore, Md., Secretary.

Wireless Club of the Shortridge High School.—Robert C. Schimmel, 2220 N. Penn St., Indianapolis, Ind., President; George R. Popp, Vice President; Bayard Brill, Treasurer; Oliver Hamilton, Secretary.

For Practical Electrical Workers

Electrical Wiring

English and American Practice Compared

By FRANK BROADBENT, M. I. E. E.

PART II.

When switches as well as fuses are used in a distribution box, the tumbler pattern is the common type used in England, and an illustration of a typical box is given in Fig. 13. This compares with the American cabinet or panel board shown in Fig. 14. In the latter, double pole switches of the open type are used, a type which no respectable contractor in England would dream of using for such a purpose; in fact he would have difficulty in obtaining them, unless he imported them. Most supply systems in England are on the three-wire system, in which the middle wire is "earthed." There is no need for a switch on the earthed wire, and it is preferable not to use one, hence a single pole switch on the outer or "live" wires is almost the invariable practice.

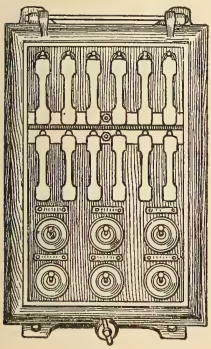


FIG. 13. ENGLISH DISTRIBUTION BOX

The main fuses on an installation fed from the street mains, or, as we call them, the "house service-fuses" are, in England, usually enclosed in iron cases or boxes. Such fuses are frequently of the cartridge type and typical samples are shown in Figs. 15 and 16. It is rarely that the positive and negative fuses are fitted in one case, but usually in separate cases having hinged lids so arranged that it is not possible to open the lids or doors of both fuses at the same time. This arrangement is essential on circuits of over 250 volts in order to comply with the spirit of the Home Office regulations,

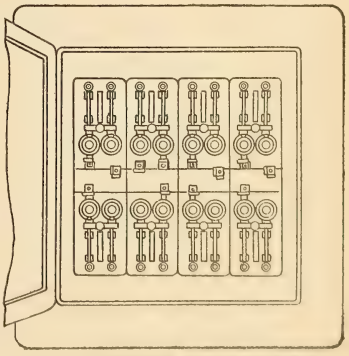


FIG. 14. AMERICAN DISTRIBUTION BOX

which require that it shall be practically impossible for any unskilled person to make simultaneous contact with both poles of a medium pressure supply service. For the same reason, separate doors are provided for positive and negative panels of a distributing box or cabinet—some simple method of interlocking the doors being provided to prevent both doors being fully opened at one time. Generally speaking, it is necessary to provide not only main fuses at the point of supply, but also a main isolating switch by means of which the whole installation can be cut off and made dead. A typical American pattern of service entrance cabinet is shown in Fig. 17. This type of thing would not be passed in England by the Home Office or Board of Trade, nor would the insurance companies look upon it favorably, because it is necessary to open the case in order to switch off the current, and there is considerable risk of an operator

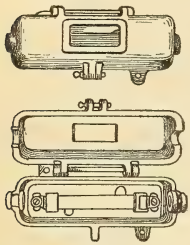


FIG. 15. ENGLISH HOUSE SERVICE FUSES AND CASE

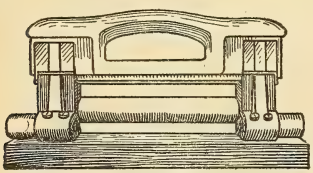


FIG. 16. ENGLISH SERVICE FUSE

touching the case and a live contact at the same time. In England, the standard practice for enclosed double pole switches is to have the switch handle outside the case, so that the switch can be put on or off without opening the doors, and therefore without risk of receiving a shock or burn. The switch should invariably be placed

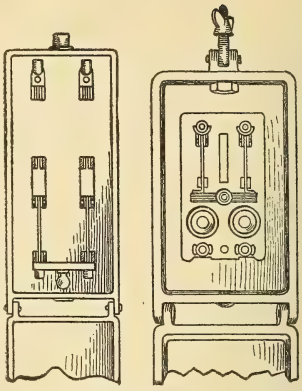


FIG. 17. AMERICAN SERVICE ENTRANCE CABINET

on the live side of the fuse, so that the fuse can be made dead before handling it for the purpose of replacement. The practice is becoming increasingly popular of combining the switch with the fuses, and the "push-and-pull" switch shown in Fig. 18 has a large sale in England. In this pattern the fuses are carried on a frame held by springs to the inside of

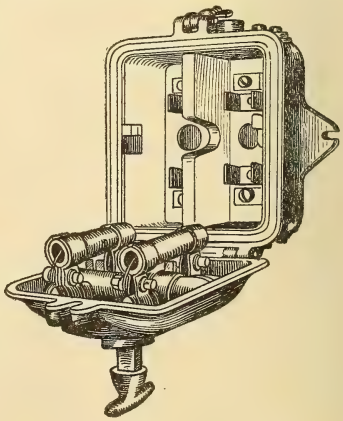


FIG. 18. "PUSH-AND-PULL" SWITCH

the switch cover and can be pushed in or pulled out by the knob. When the switch cover is opened the fuses are quite clear of the live terminals, and the switch must be "off" before the switch door can be either opened or closed, so that the thing is practically what is called "foolproof"—an Americanism, I think. In England one must, according to Home Office requirements, have a clear space of three feet between the wall and any live connection at the back of the switchboard, so that if the board can be made without any live connections at the back this useful space can be saved. A switchboard used on a factory installation designed by the writer is shown in Fig. 19.

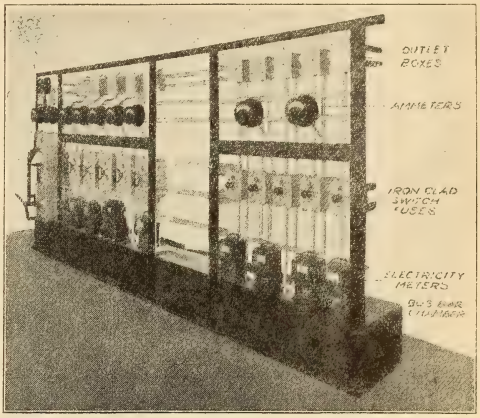


FIG. 19. ENGLISH FACTORY SWITCHBOARD

Touching now on the smaller accessories used, such as lampholders and wall sockets, marked differences are to be observed between what is standard English and standard American practice. A glance through any American accessories catalogue would indicate that the screw socket lampholder is, if not the universal practice, at any rate the recognized standard practice. In England this type of holder is very rarely used (except, perhaps, for large candlepower lamps), the bayonet holder, Fig. 20, being the recognized standard. As in the case of the screw fuse plug, the Edison screw holder may be seen on the tube railways where American equipments have been used, but apart from this the screw socket holder is more or less of a curiosity. Keyholders, that is, lampholders embodying key switches, although they are largely used in England for domestic and other purposes, have never really been favored either by the insurance companies or the Home Office authorities.

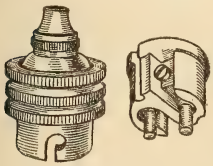


FIG. 20. BAYONET LAMP HOLDER

Closely allied to the lampholder is the "ceiling rose," as we call it, or, as it is called in America, the "rosette." There appear to be far more types of this in America than in England, where the ceiling rose has been so standardized as to be reduced to very few patterns. A rosette containing a fuse is now practically an unseen thing in England, and is disapproved by all the insurance companies. Neither is it permitted to tie a knot in the flexible cord so as to take the weight of the pendant on the cover of the ceiling rose, as appears to be permitted in America by the National Electrical Code. A typical ceiling rose is shown in Fig. 21, from which it is seen that a porcelain bridge is provided containing holes through which the flexible cord is threaded, the whole of the weight of the fitting being taken on this bridge and

none of it on the cover or on the terminals.

The same differences in practice which apply to lampholders hold also with regard to "wall sockets," as we call them, or, as they are termed in America, "receptacles." Here, again, the American practice tends largely to the screw socket type of receptacle, so that a lampholder plug or fuse plug would be interchangeable for these fittings. In England the practice tends more and more towards the two-pin plug, as shown in Fig. 22.

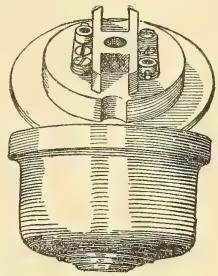


FIG. 21. "CEILING ROSE"

Attachment plugs are passing through a kind of transition stage at present owing to the new rules of the Home Office. Flexible cord coming out through the end of the plug passes through the hands of the person using it. The type recently required shows the cord coming out at the side, Fig. 22.

Touching briefly on the actual wiring work of an installation, while there have been many attempts in England to introduce cheap systems, the regular practice at present is the unlined conduit system. There is still a certain amount of wiring done in moulding or, as we call it, wood casing, and in domestic installations a combination of the conduit and wood casing systems is very frequently used, the conduit being used for sunk or concealed work and the wood moulding for open or face work. The tendency, however, is more and more towards complete conduit systems owing to the requirements of the insurance companies by which all conduits must be earthed, and if this is broken up by moulding it is difficult to earth the isolated lengths. The highest class of work is considered in England to be a complete screw conduit system, in which the conduits are metallically and electrically continuous throughout, that is to say there is no break in the metallic continuity of the system anywhere. The conduit is generally earthed on to the sheathing of the supply company's cables, which are earthed at the generating station, as is also the middle wire of the system when this happens, as is commonly the case, to be a three-wire system. By this means we are always assured that conduit is at earth potential and, moreover, it is not possible under the worst conditions to get a shock of more than half the full pressure of the system. For domestic supply the maximum pressure permissible on the outers is 500 volts, so that 250 volts is the highest pressure to which one might be subjected between earth and any live conductor.

Among the systems which have been recently introduced with a view to simplifying and cheapening wiring is that known as the "Stannos," which is a revival of the old concentric system which a few years ago was popular, particularly for ship lighting work. In the "Stannos" concentric system an insulated wire or conductor is enclosed in a copper tube, which is lapped on to the insulation by special machinery and is sufficiently flex-

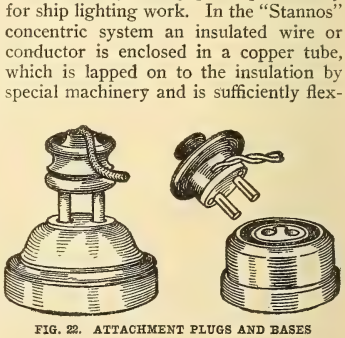


FIG. 22. ATTACHMENT PLUGS AND BASES

ible to be bent round easy curves. This system is making headway, and lends itself to interior work where it is desired to keep all the conductors exposed on the wall and ceilings.

For double wiring where it is not practicable to use the outer sheathing as a

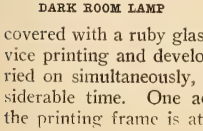
conductor, twin conductors are made up, in which the copper tube serves merely as a protecting cover or flexible conduit, and not as a conductor. This system is being exploited by Siemens Bros., and other systems of an allied character are being put on the market by the cable manufacturing companies, among which the "Henley" wiring system might be mentioned. The difficulty with all these new systems is that they have to overcome the prejudices of the insurance companies' inspectors, as each insurance company here is practically a law to itself, and there is no central authority such as the National Board of Fire Underwriters in America.

There have been several attempts to popularize twin lead-covered wiring systems, but without success; and the flexible cord system, so popular on the continent, has no chance of success in England. To sum up, wiring practice in England has practically settled down to a conduit system, which, for the cheapest class of work, is the slip joint system pioneered by the Simplex Company, screw conduit being used whenever the customer will pay the price and for all the best work.

(The End.)

Combination Lamp for Photography

A very useful combination for photographic dark rooms is shown in the drawing. A frosted incandescent lamp is enclosed in a box, the cover of which consists of a printing frame with the glass inside. The front of the box is left open and is covered with a ruby glass. With this device printing and developing can be carried on simultaneously, thus saving considerable time. One advantage is that the printing frame is at a fixed position from the lamp, and exposures of equal length will produce uniform results. The ruby glass can be arranged so as to be removable, and a deep yellow glass can be substituted when printing paper is being used.



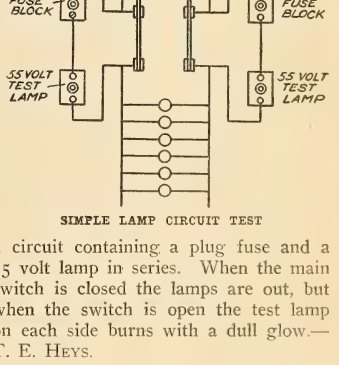
DARK ROOM LAMP

Correction

In Fig. 10 on page 388 of the August issue the single wire from the three point switches on the second and third floors should be shown as connected to the right hand instead of the left hand main.

Testing for Lamps "On"

The arrangement shown in this diagram I have used to discover whether any electric lamps were lighted in a building. From the jaws to the hinges of the service switch on each side I run



SIMPLE LAMP CIRCUIT TEST

a circuit containing a plug fuse and a 55 volt lamp in series. When the main switch is closed the lamps are out, but when the switch is open the test lamp on each side burns with a dull glow.—T. E. Heys.

If a battery is discharged until it is practically empty, it should be charged again, at least partially, without much delay. If allowed to stand for any length of time, more than the usual number of kilowatt hours of current will be required to get it back again to a fully charged condition.

Electric Bell Circuits and Their Installation

By C. V. DAVIS

Signal wires may be supported on wood in dry places with metal staples, Fig. 1, A, driven into the timber. Never fasten more than one wire under a staple unless the wires are first protected with a tape wrapping. In damp places, ordinary staples rust and eat through the insulation. It is very difficult to drive round top staples in straight; staples having square tops, of a style narrower than the ordinary double pointed tacks, are best. Zinc coated staples are preferable to coppered ones. Insulating saddle staples, Fig. 1, B, are probably as cheap in the long run as the ordinary metal ones, as two wires can be held without "shorting" under one saddle staple, and they secure the wire well at turns and prevent the metal from cutting into the insulation. In stringing a long run, a saddled staple at the end will hold the slack until the intermediate staples are placed.

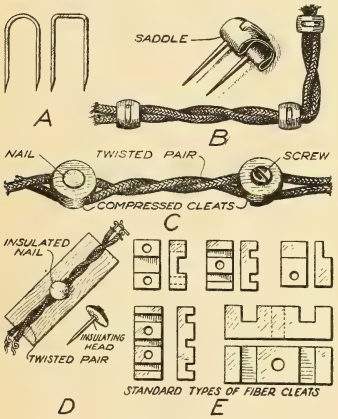


FIG. 1. BELL WIRING MATERIALS

Cleats of compressed, impregnated wood, Fig. 1, C, are good for supporting a twisted pair conductor in an exposed place, as they are neat in appearance. Either nails or screws may be used to hold them. They are particularly useful for runs over plastered surfaces, and in places where staples cannot be used. When stringing long runs of wire, compressed wood cleats at the run ends will hold the slack until the intermediate cleats are placed. These wood cleats cost less than porcelain or fiber. They can also be used to support single wires, one wire under a cleat.

Insulated nails, Fig. 1, D, having a metal stem and a head of insulating material, may be used to support twisted pair conductors, and while they are cheap, they do not support the wires as well as does the wood cleat. They do not hold a single wire well and do not properly hold back slack in long runs. The nails are made in different lengths and with heads of different colors to match surroundings.

Hard fiber cleats, Fig. 1, E, may be used where one or more single conductors are to be supported, but are not as good as the wood cleats, although they cost more. It is sometimes necessary to use them where the wire supported is too large for the standard wood cleats. The various styles are shown.

Wire for bell work in dry places is usually No. 18 copper, double cotton

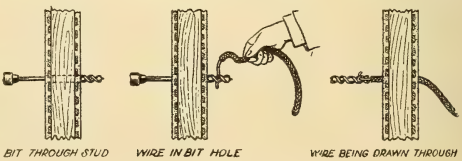


FIG. 2. USE OF STEEL FISH BIT

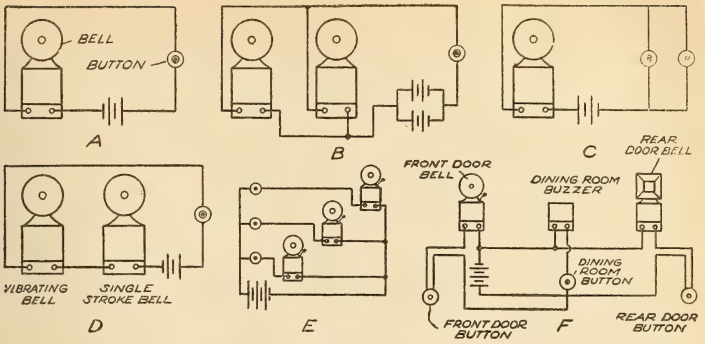


FIG. 3. BELL CIRCUITS

covered and paraffined. Where more than two or three bells are connected to the circuit, or where the circuits are long, No. 16 wire should be used. No. 14 is frequently used for battery wires. Rubber covered twisted pair wires, like those used for interior telephone wiring by the telephone companies, can often be used to advantage in damp places or where the circuits are exposed. No. 20 wire, although sometimes used, is too small for reliable work. Annunciator and twisted pair wire is made with insulating coverings of different colors, so one can be selected that will match the surroundings, and, thereby, be inconspicuous. Cables of annunciator wire, which can be obtained with practically any number of conductors from two up to 200, are very convenient and economical for large installations. In perfectly dry locations a cable having a paraffined, braided cotton covering can be used, but if it is to be exposed to dampness, a lead covered cable should be installed. The cable conductors, being covered with braids of different colors, can be readily identified. A kind of weatherproof wire called "dampproof" is quite satisfactory for exposed wiring in damp places. It is more expensive than annunciator wire, but it has a better appearance when installed.

Wires can be supported in unfinished houses by fastening them to the studs and joists with staples. In finished houses wires can be run behind a base board or on top of the molding, or, by prying up a floor board, the wires can be placed under it. A saw cut, into which the wires can be dropped, can be made in any joist that lies across the path of the wire.

In fishing for vertical wires, a piece of small chain two feet long is attached to a length of strong cord. The chain and cord may be run through a hole bored for the wire at the top of the partition, and the noise made by the chain when the cord is pulled up and down will indicate the location of any obstruction. With the obstruction located, the floor board can be taken out and a hole bored through.

The steel fish bit, Fig. 2, is a useful tool in installing signal wires. The bit has a hole in its end. After the bit has drilled through, the wire to be drawn in is threaded into the hole and the wire and bit are together drawn back. In a floor or ceiling, the hole having been bored, it may be more convenient to first withdraw the bit and then to thread the wire through the hole at the end of the bit and to push the bit back through the hole. Good bits of this type are so tempered that they will drill through wood, masonry, wrought iron struc-

tural steel or plaster.

Electric bell circuits are shown in Fig. 3. (A) is a simple bell circuit; (B), two bells controlled from one button; (C), one bell controlled from two different points; (D), two bells in series, one vibrating and one single stroke controlled by one button; (E), three bells and three buttons with a common return wire; (F), house bell wiring diagram. Two ordinary vibrating bells will not work well in series, so one of the two should be a single stroke bell.

Where several signal bells are located together, gongs of different types, Fig. 3, F, each of which gives a different sound, can be used. In operating bells from an electric light circuit, a bell ringing transformer, which can be purchased, may be used, and then there are no batteries to be renewed.

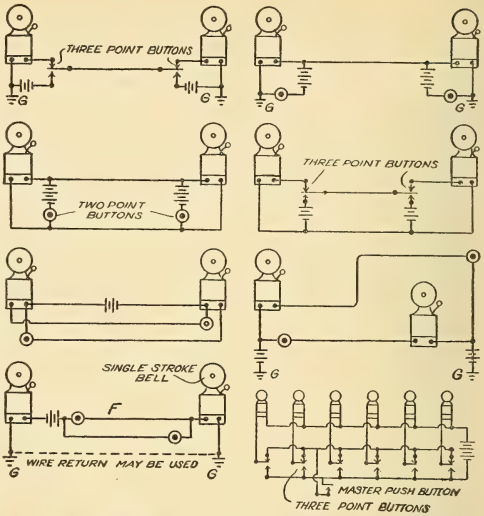


FIG. 4. RETURN CALL AND MASTER BUTTON CIRCUITS

Return call bell circuits for different services are shown in Fig. 4. These are readily understood from the diagrams. With these, when a station is signaled, the party called can signal back by pressing his button. As a general proposition, ground return circuits are undesirable, as one ground on one of the normally ungrounded wires may render the system inoperative. With the arrangement of Fig. 4, F, when the calling station is the one at the single stroke bell, the caller may be sure that the called station is ringing, because it is the vibrating bell at that station that causes the single stroke bell to ring.

Apartment house and speaking tube bell wiring circuits are shown in Fig. 5. One battery serves for all stations. Frequently a larger sized wire than for the other wiring is used for the battery wire, which supplies all of the stations. (A) is a speaking tube bell system operated from one battery. Bells on any other floor can be rung from any station. (B)

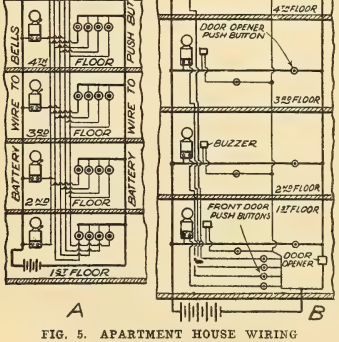


FIG. 5. APARTMENT HOUSE WIRING

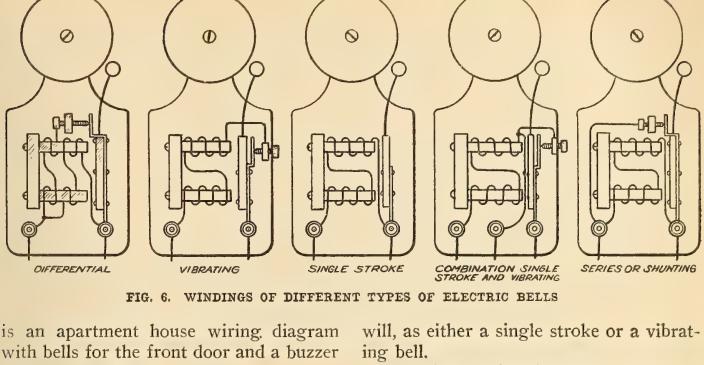


FIG. 6. WINDINGS OF DIFFERENT TYPES OF ELECTRIC BELLS

is an apartment house wiring diagram with bells for the front door and a buzzer for each rear door.

Electric bells of different types are shown in Fig. 6. The vibrating bell is the one commonly used. The single

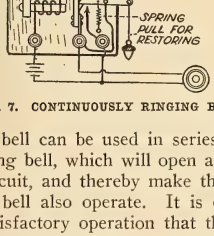


FIG. 7. CONTINUOUSLY RINGING BELL

stroke bell can be used in series with a vibrating bell, which will open and close the circuit, and thereby make the single stroke bell also operate. It is essential for satisfactory operation that the natural periods of vibration of the armatures and tappers for both bells be the same. A vibrating bell can be changed into a series bell by so adjusting the vibrating contact screw that the circuit will not be opened when the armature is drawn over. A single combination stroke and vibrating bell is a combination of the windings of a vibrating and a single stroke bell, and can be used as either by properly connecting it. A two point switch can be arranged so that a bell of this kind can be made to operate at will, as either a single stroke or a vibrating bell.

In series or shunting bells, each time the armature is drawn over it makes a contact and short circuits the magnets, thereby demagnetizing them; the armature spring draws the armature back and the operation is repeated. Bells of this type have been designed for use on some circuits to minimize arcing at the vibrating contact.

In the differential bell, the magnets are wound differentially—that is, so that the windings oppose one another. Hence, when the armature is drawn over by one magnet winding, it makes a contact which energizes the other winding,

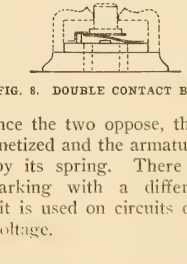


FIG. 8. DOUBLE CONTACT BUTTON

and since the two oppose, the cores are demagnetized and the armature is drawn back by its spring. There is little or no sparking with a differential bell, hence it is used on circuits of relatively high voltage.

A continuously ringing bell, Fig. 7, is so arranged that when the button is pressed and the circuit closed through the bell, the armature is drawn over and the latch released and pulled down against its contact point by a spring or by gravity. This connects a shunt circuit around the button, and the bell continues to ring until the latch is restored.

A double contact, three point or return call push button, Fig. 8, is used in return call bells and annunciator circuits. Applications of push buttons of this type are shown in the diagrams.—C. V. Davis.

A Sherlock of the Skies

By RENE MANSFIELD

(Concluded from page 539)

It also seemed strange that the man should keep his cabin door tightly closed, when the wind, though a hot one, made the terrific heat a little more endurable. Acting on impulse Mitchell jumped from his seat and stealing quickly around to the side of the little cabin looked into the open window. The red-haired man had seated himself at a rough table and was dealing a pack of ragged, greasy cards to the man who, with one leg swathed in clumsy bandages, lay on the bunk up to which the table had been pushed. Mitchell suppressed a yell of joy. The man with the bandaged leg was Guy Forbes!

Running around to the front of the cabin Mitchell burst through the door like a catapult.

"Forbes, old man! I knew you hadn't cashed in! I knew it. Look here, you—" turning to the squatter who had risen wrathfully, "What'd you tell me that lie for—what do you mean, anyhow—what you trying to do?"

"Why, you see, partner," the flashing look of anger had been quickly succeeded by an ingratiating gentleness of manner, "'taint every day—'taint once in a year, scarcely, I get a chanct to deal the pasteboards to anybody but meself. An' I just couldn't b'ar to have you take your friend here away. You got no idee how all-fired lonesome I——"

Mitchell turned to Forbes impatiently. "Why didn't this man try to communicate with us? And where's the Gull?"

"One at a time, Mitch, please," smiled Forbes. "I thought some of you fellows would find me sooner or later. Rather expected you sooner, to tell the truth. And 40 miles looked like some walk to our friend here. The Gull? You know as much about her as I do. I left her a couple of hundred feet up in the air."

"But you started for Edgarville, Forbes. How in the deuce should we have known you'd strike off due north instead of east?"

"Why, man alive, I got a wireless to switch my course almost before I was out of sight of camp. You all knew that?"

"No! By George, we didn't! Forbes, there's queer work here, somewhere. Quinn must have sent that message. Why has he kept quiet about it?

"Does Quinn use the Continental code?"

"No, he doesn't."

"The message was sent Continental. I wondered about it at the time."

"But the Gull, Forbes?"

"I told you—left her 200 feet in the air. Funny thing happened, Mitchell. Can't account for it. The aneroid barometer exploded. In no time a little tongue of flame had leaped to the upper plane. I could see the Gull was doomed."

"Half-blind, I managed to get hold of my parachute and swing loose from the crackling machine.

"Donovan, here, dragged me, still unconscious, to his cabin and between us we turned a neat trick in bandaging. He has failed to discover the slightest trace

of the Gull—must have burnt to a cinder in mid-air. Funny some of the metal work isn't lying around, though, eh, Mitchell?"

The question was put lightly, but Mitchell sensed the wary suspicion in Forbes' tone. Donovan was shuffling his cards with great precision and attention.

"O, Donovan didn't look very sharp, probably, that's all—yes, Donovan?"

"My eye sight ain't what it was—not by a long shot," replied Donovan, a shade too eagerly. "Now, like es not——"

"Sure." Mitchell cut him off sharply. "We don't care about the Gull so long as Forbes is all right. Now, lend a hand, Donovan, while we get him into my machine."

The squatter was pitifully concerned. "Why, he ain't no more fit to be moved than a baby. Things is li'ble to set in bad from that there leg o' his. Better leave him here fer a day or so. I can tend him first class——"

Mitchell drew a revolver from his hip pocket, examined it leisurely and replaced it again.

"You just get over there on the left side, Donovan," he said quietly, "and do as I tell you. There, how's that Forbes? All right? Come along, now, Donovan."

Between them they carried Forbes to the biplane and placed him in the passenger's seat. In a moment Mitchell was beside him and the plane shot up into the sky, leaving Donovan enveloped in a whirl of dust.

"Why, say, you aren't headed for camp, old man," said Forbes presently.

"I know it, Forbes. I'm not going to take you back to camp. I'm heading for El Rosa. I want you to stay there for a few days till I clear this thing up.

"Who would be interested in preventing you from accomplishing your flight to Edgarville that would have broken all wireless records and undoubtedly won for you Ferris' $10,000 bonus, besides putting you in the way of entering the International next week as the company's star, if you had succeeded? Anybody but Baring and Bouvier? I'm not going to tell you more now, but I think you'll hear from me in the course of a couple of days at the most."

Having established Forbes with a physician whom he knew at El Rosa, which he was able to accomplish with secrecy since the doctor's house stood in the center of a large ranch, Mitchell took wing again impatiently. Had Forbes taken notice of his course he would have seen that he flew, not toward camp, but in a bee-line for Donovan's cabin.

It was late the following afternoon that Mitchell asked Holmes, the president of the company, to call a meeting of the aviators. When they had assembled about the long table in the directors' room apprehensive of bad news about Forbes, for whom an unremitting search had been kept up, Mitchell took the floor at once, with a gravity that boded ill.

"Gentlemen," his voice was unsteady —"gentlemen, I have the painful duty of telling you that our search for Guy Forbes is ended. You will never see the Gull again, driven by that fearless, that brilliant—that——" He was scarcely able to go on. When he had his voice again under control, he said simply, "I shall try to tell you as briefly as possible what I have learned.

"Yesterday, although it had been accepted that Forbes could have flown in no direction except toward Edgarville, something seemed to prompt me to take a little spurt due north. Twenty—forty miles I flew over that desolate country which is quite uninhabited, losing hope with every mile. Just when I had made up my mind to turn back, I sighted a little shack where at any rate I determined to make inquiries.

"Gentlemen, it isn't necessary for me to tell you by what means I made certain discoveries that clear up the mystery of Forbes' disappearance. Suffice it to say that buried in the sand behind that shack I found twisted scraps of metal, and warped, charred bits of woodwork, which

is all that remains of Forbes' biplane.

"The Gull was burned almost to a cinder 200 feet up in the air. It was not an accident, gentlemen. It was a fiendishly conceived plan. I know whose work it was, and I know, beyond any question of doubt, who was responsible for Guy Forbes' horrible death."

Baring was on his feet in a moment. "I know also! I have had my suspicions from the first. I have evidence to show ——"

"It's a lie! He's alive and you——" Bouvier's lips closed with a snap over the words that had burst from him uncontrollably. It was too late.

Mitchell turned upon him savagely.

"Ah, Bouvier, you'll speak, will you? How do you know Guy Forbes isn't dead? How do you know it, I say?"

Bouvier's head fell into his hands, as he sank back into his chair. "O, I tell you everything—I tell you everything," he muttered. "I can not stand it——"

"I'll save you the trouble, you contemptible scamp," cried Mitchell. "Ten thousand dollars, and the company back of you for the International next week—you intended to win out on that proposition by fair means or foul, didn't you? You knew that if Forbes succeeded in reaching Edgarville day before yesterday your chance of breaking his record was slim.

"You bribed Quinn to leave the generating plant for an hour. You repaired the gearing temporarily, so that after Forbes was well on his way toward Edgarville you were able to swing the L around to the north, after telegraphing him to change his course. Having calculated his speed to a nicety, when you knew him to be in the vicinity of Donovan's shack, you gave him suddenly the full voltage of the power beam, which, you knew from previous experiment, would kill the engine and in all probability explode the aneroid barometer. You then shut off the power, swung the L around again, restored the gearing to its former condition and left the rest to Donovan, 40 miles away, who was to remove any evidence of that midair tragedy that might exist. In case Forbes, by some miracle, escaped, Donovan was instructed to hold him prisoner until after the International. Too bad you didn't discover that tell-tale tracing in the sand, Bouvier. Any details you'd care to add?"

The Frenchman only sat and shook.

"Think you can get out of the country tonight?" inquired Holmes.

Bouvier bowed.

"Then git" said Holmes, forcibly, if inelegantly.

Mitchell had opened the door of a smaller room near by and Guy Forbes himself limped into the room, to be surrounded at once by a group of howling madmen.

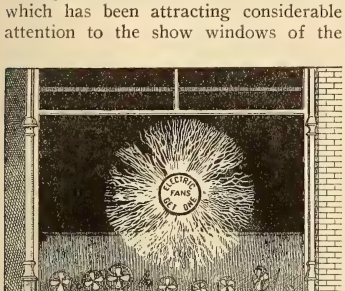
"My little trip through the fiery furnace indefinitely postponed, fellows!" he cried above the din. "Ouch! Get away from that leg of mine."

Electricity the Silent Salesman

Some helpful hints on the use of electric current in getting up show window displays. The following schemes have all been used with remarkable success.

Fan Advertisement

The accompanying illustration shows a unique advertisement for electric fans which has been attracting considerable attention to the show windows of the



UNIQUE FAN ADVERTISEMENT

Manchester, N. H., Traction, Light and Power Company. It consists of a translucent center piece, bearing upon its white surface the words in letters of black, "Electric Fans—Get One," and from whose circumference a great number of flexible white streamers are made to radiate.

A sixteen inch non-oscillating electric fan is made to blow directly upon the center piece from a point slightly lower down and its powerful blast causes the streamers to distend themselves out in all directions.

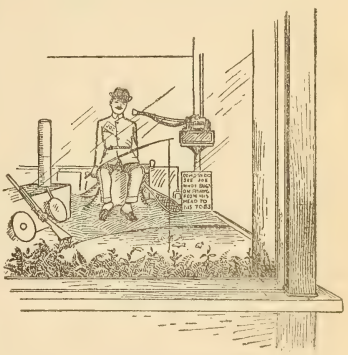
At night the center piece is tinged with a ruddy hue by means of a colored lamp placed behind.

The device has several things about it to render it an efficient advertising arrangement, viz:—It is something new; it is prominent and it is in motion. The present scheme is the result of a number of experiments, some of which have shown the possibility of arranging the streamers in other and as novel forms. Thus, they can be made to stand up from the window floor by a fan placed beneath and made to take the form of waving wheat or, with a little ingenuity, leaping flames.

Doing Business Between Bites

During hot summer days suggestions of cool woods and fishing are alluring. A dictagraph company is using this fact to call attention to the service its device may render to the business man in camp.

A fisherman's camp is accurately dis-



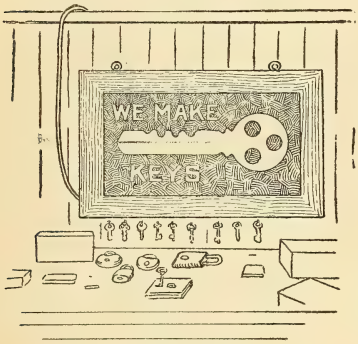
DISPLAY DICTAPHONE

played and, while the angler watches the "bobber," he may, between bites, talk his correspondence into a dictagraph and later mail the cylinder to his place of business.

Much realism is added to the scene by a concealed electric motor which operates the fisherman's arm, causing the fish pole to move and lift the hook out of the water at intervals.

An Illuminated Key Sign

A locksmith uses an illuminated glass key sign placed in his window among such articles as a shop of this kind would carry. The sign is large enough to be

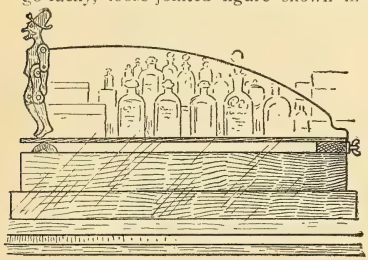


ILLUMINATED KEY SIGN

plainly seen from across the street and uses a sixteen candlepower lamp for illumination.

The Jolly Gymnast

A Chicago druggist calls attention to his window display of liniment and arnica by placing at its center the happy-go-lucky, loose-jointed figure shown in

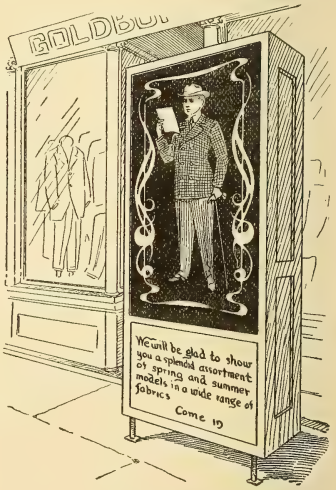


ODD WINDOW DISPLAY IN DRUG STORE

the accompanying illustration. The board under the figure's feet is made to vibrate rapidly up and down by a small motor, causing the jolly gymnast to throw his arms wildly about and to perform all sorts of quick movements with his feet, his point of support being a length of spring wire.

Fashion Cabinet

Goods in the piece may look somewhat different when made into a garment or suit. Partly to aid in settling this question and also to serve as an attractive clothing advertisement is the purpose of the Newman fashion cabinet. The front



FASHION CABINET

of the cabinet is a piece of plate glass 20 by 36 inches, upon which is the outline of the figure of a man or woman, the surrounding glass being opaque. Behind the glass is a rotary arrangement for bringing one piece of cloth after another up close to the glass, thus making the figure outlined appear to be clad in one suit after another. The cloth changing device is operated by a small motor.

The Inventor, Who He Is and Why

By GEORGE FREDERIC STRATTON

In the marvelous achievements in engineering and mechanics which have developed the methods of Tubal Cain into the astounding equipment and products of the great steel industry of today; which have superseded the hundred oared galley of Cleopatra by the thirty thousand horsepower ocean greyhound, many of the greatest strides in the invention of machines and processes have been made by men who had genius without one iota of training. Often they have not the rudiments of education, and are without one existing example of the thing their minds were creating, to study, to emulate or to enthuse.

There's the puzzle! What psychological explanation can be made of the mind impulses of Stephenson, who evolved the locomotive at the same time that he was teaching himself simple arithmetic; of Arkwright, the barber, who thought out and perfected one of the most intricate and ingenious of machines—the spinning jenny—at a period when machinery and mechanical movements were practically unknown; of Morse, the artist, who turned from his beloved profession and devoted his life and his means to the invention of the instrumentation and installation of the electric telegraph; of Whitney, the law student, who invented the marvelous cotton gin; of Bell, the physician, who created the telephone?

There is an old axiom which, with a few others, requires rebuilding; or, better still, relegating to some antiquarian museum where age is sufficient qualification for a glass case: "Necessity is the Mother of Invention." The man who devised that was obsessed by a briefness which obliterated his meaning, or he was not an observer of inventors. Necessity has undoubtedly been an impelling and insistent motive for some inventions, but so broad and distinctive an appellation as "Mother of Inventions" is entirely destroyed by a very cursory study of the Art, the Profession, or the Trade—which is it?

Some other Mother must be sought. Thousands of useful and valuable inventions have been made by men as the result of hobbies or pastimes. The necessity for the article had no appeal to them. It was the—perhaps—instinct to invent—an instinct which is possessed in some degree by every man, woman and child today, and has been so possessed since the men, women and children of the Stone Age found that life meant effort. Watch the most unambitious man, who, after 50 weeks of routine in the most monotonous work, gets into a camp for two weeks. He is full of suggestions and ideas for overcoming the rough places. Impracticable they may be, and often unnecessary, but he is full of the instinct of invention. Watch the young wife, or the older one, continually rearranging her home equipment for better convenience or tastier appearance; partitioning a closet, planning a new window, transforming a dull corner into a tempting alcove. It is the instinct of invention.

Above all, watch the boy, from the day he enters primary school until he goes under the discipline of a paymaster. Through every hour of every day he is planning some new way to do work, or to dodge it; to beat the other fellows in sports of skill or chance by some new movement or some new method of using an old plaything. The instinct of invention is strong in him and will stay by him—subdued, perhaps—until he dies. He may develop into a thoroughly bad man, or into a shiftless, improvident fellow, or he may become the president of these United States; but the instinct of invention never leaves him.

Yet, of all the great or little capabilities of man, or all his instincts, proclivi-

ties, ambitions and desires, this one great impelling instinct—if I am using the proper term—of invention is the only one that has been left without any attempt at systematic training and development; that is, in the line commonly accepted as invention. Every other capacity of man, physical as well as mental, has its colleges, institutes, training schools or advisory mentors. There are cults, new thought schools, isms and ologies to meet every phase of human action and human thought, except that of inventiveness.

This has not been overlooked. During the past decade, and perhaps before, suggestions have been made, in a desultory way, of the possible value of systematic training institutes for those who show marked inventive ability. But they have been met by the objections that inventors cannot be made; that invention is overdone; that the true inventor is of much too independent thought and impulse to submit to any control of those qualities; that the inventive capacity of men has been shown in a vast number of very successful results to have had no training —sometimes no education—back of it, and therefore such training seems to be unnecessary; that it may be questioned whether routine study of fundamental physical laws and conditions would not be detrimental to imagination.

Those objections indicate that the inventor who cannot help inventing is not understood. When his ideas are impractical he is called visionary; when they are eminently practical and valuable, his frequent failure to realize their rewards bring upon him the grim criticism of being utterly deficient in business sense, or even horse sense. And frequently both criticisms are fair; but are the causes—the entire lack of any effort to supply the qualities which such inventors need—are they fair?

There has been another reason given against the establishment of any especial facilities for training inventors—a reason which on the surface appears stronger than the others. It is that the man who is filled with the inventive spirit is almost always in some position—in production, distribution, or in a profession—where he is earning a livelihood, and that no matter what the position is, it gives him an acquaintance with the requirements of himself and his associates, and consequently the opportunity to exercise his inventive faculties. He is assumed to be continually getting training in his daily association with the shortcomings of, and the call for improvements in, the appliances of the business.

That is a plausible and apparently logical assumption, but, as a lawyer would say, although the premises are correct, the deduction is incorrect. One of the most insistent points which come to any one making a very cursory study of inventors is the fact that the great majority of such men invent things which have not the remotest connection with their daily occupations.

A patent attorney in one of the Mid-West cities showed me recently a record he had compiled of the occupations of his clients, and of others of whom he had been able to secure information in his visits to the Patent Department at Washington. His list gave nearly 1,000 names, and 65 per cent were of men who had secured patents for inventions or improvements on articles entirely disconnected with their regular work.

That's where the inventor is a puzzle again. A sea captain invents a rock drill; a bookkeeper invents a combination vise and anvil; a machinist invents a hay rack for farm wagons; a sawmill operator invents an adjustable sash for hot houses; a lawyer invents a steering gear for motor boats. Thousands of such incongruities can be found, but tens of thousands would prove no more conclusively than the few given that the inventor is an unknown quantity. You never know—he never knows himself—where he will break out next; and the result—the inevitable result—is an enormous waste of thought, brilliant ideas, dogged perseverance and often pathetic

self denial on articles which, although practical, are unnecessary; although marvels of ingenuity, are too costly; although simplified to the last notch, are lacking in selling appeal. The business sense—the one insistent principle of considering results as closely as methods—is too often blotted out of the inventor's brain by the fascination of his present endeavor. It has been stated by patent experts that 75 per cent of the patents secured fail to repay even the cost of securing them. The expenditure of energy, talent—yes, and downright genius—that is thereby wasted, a large proportion of which might be diverted, by proper warning, control and encouragement, to improvements for the benefit of the world, is appalling.

The inveterate inventor or the spasmodic inventor usually is actuated by irregular impulses and imaginations. At home, at work, on the street car, at a dinner or a wedding, some article or some difficulty comes to his notice which flashes into his brain the idea of an improvement or a substitute, and forthwith he invents it. The obsession is to make something that no other man has thought of. Here is where early training in logical reasoning of ultimate results—training in business principles and business acumen—would count.

Such training comes incidentally to the engineers of a great manufacturing or transportation enterprise. Such men are frequently inventors, for their work calls continually for the inventive faculty, but with it they are under the discipline of duty and the stern necessity of thoroughly considering and estimating the ultimate practical value of the invention or improvement, its cost and probable profit.

The value of a professional salaried inventor under direction and control has been demonstrated to a remarkable degree in some of the great manufacturing plants. In that of one of the great electrical machinery manufacturing companies there was employed several years ago a plumber, working at his trade among the numerous shops. Some months after he commenced, the superintendent observed that he was very fertile in ingenious expedients, and he watched him. The watching really developed into a study. The plumber was a chronic inventor; he couldn't help it. It was found that he had secured three patents on articles not used in plumbing, in return for which he had nothing to show but the papers. He was taken off the plumbing, told to wander round the shops and "invent" savings, and warned against "monkeying" with any new devices. His work was to find saving chances or to invent them.

He wandered about the plant at will, studying the machines and the products, no matter how large or how small. The greatest boring mill or the smallest bench tool, a trifling reduction in the weight of some casting, or the substitution of some standard piece for a special piece, alike engaged his attention. He invented constantly—little things, it is true, but the aggregate saving in cost or gain in efficiency was so great that four years later he was drawing a salary of $3,000 a year. A trifling ingenious change of a casting pattern would often save a few cents' worth of machining, and a few cents' worth of material, and in the large quantity of each part manufactured a very small saving would amount to a respectable sum in one year. For instance, three months after he had been on the job he argued for and secured a slight change in the casings of railway motors, by which two bolts and the necessary drilling were eliminated. The saving was 26 cents on an article which costs over $200. But 30,000 of such motors are turned out of the shops each year, and the total saving was nearly $8,000 each year. Of course, as he got settled into the work he frequently devised improvements in various apparatus, increasing its efficiency.

This case is cited because it is a fair type of others. Large manufacturers

are fully alive to the value of such men, but they find it almost impossible to obtain them. One of the great automobile manufacturers recently said:

"There are hundreds—perhaps thousands—of inventors who have the brains we want. Many of them are just earning a living at some occupation, but, although we would double or triple those earnings at the start, we can't get an inventor who'll respond to control. They switch off from work we want to any idea that occurs to them, and then their minds are too much engrossed to get back to where we want them. I suppose if we took a *young* fellow we could break him in to an understanding of business requirements and business policy; but we've got to have a man—or several—who have proved their mechanical ingenuity and ability to invent; and when they get to that stage, they seem to have no control over the direction of their efforts."

And the factory superintendent, speaking of the same thing, said: "We can get graduates of technical colleges, and young fellows from training schools, by the gross; but if I select one who shows ingenious original ideas on mechanical work, and tell him to go round the plant and see what improvements or savings he can devise on what we are making, he'll probably bring me, within a week, sketches of something entirely outside of our line. He has the same idea that all inventors have, that if a thing is patentable there's a fortune in it, and that we'll jump at it, no matter what it is, or how it's going to strike us. If there was a college of business invention, there'd be a mighty bright outlook for its students."

Of course the question comes in here as to whether the engineers or foremen are not competent to do the work for which the shop inventor is sought. Usually they are; but just as usually they are entirely unavailable. Ask an engineer to spend two or three days, or a week, in seeing if a factory cost saving of 25 cents is possible on a hundred dollar machine, and he'll disgustedly decline to put his training and abilities to any such insignificant detail. If the request is mandatory, he will probably resign. And the foreman who has from one to three or more hundred men in his department, and has to watch orders and supplies, has no hours to spare in studying the effect of the elimination of a two cent bolt. It is work, resulting in totals of enormous amounts, that must be done by a special man, or men—the tool expert, the shop doctor, the savings expert, or simply Mr. Brown. They are all the various designations of what is really the shop inventor.

It is a profession which is very close to its beginning. The success, where the man can be instilled with the principles of sticking to one line, and studying the needs and policies of his company, is very great. But, as one manager has remarked: "The true inventor must be caught young and taught in some systematic, effective manner that his genius, his faculties and his resourceful ingenuities must not wander all over the lot; that if he engages to invent improvements and economies in a stove foundry, he is neglecting his duty and wasting his opportunities by inventing a self propelling tooth extractor or a combined baby carriage and washing machine. The college that will take such young fellows in hand, and, letting their inventive genius alone, show them the true business application and business possibilities of such genius, will do more good for America's industries than any technical college now in existence."

Electrical Securities

By "CONTANGO"

More Interesting Facts and Figures as to What Has Been Accomplished in the Past Few Years—Striking Examples of Progress and Prosperity Indicate the Solid Future Before Those Who Invest Their Money in the Stocks and Securities of the Well Managed Public Utility Corporations.

Mention has been made many times in this series of the advantages accruing to the investor by virtue of the centralization of resources and management as typified by many of the great public service corporations today. But the average reader, as he switches on his light to read these lines, very probably has an inadequate perception of the tremendous system, electrical, mechanical, clerical, which is back of the half an ampere or so of current that flows through his lamp. He knows that somewhere away in the distance there is a dynamo which sends current over the wires, but to the intricacies of the system, the thousands and millions of dollars invested in its equipment, its instant readiness to respond to the tens of thousands of little switches of thousands of small consumers, he has more than likely given little thought.

What, then, are some of the factors back of this almost universal electrical service in our great cities which make that service ready to respond to public need? So far we have dealt quite largely in generalities concerning the investment features of these great enterprises. Let us now go somewhat into the interesting features of their operation that will show why they must be, of necessity, solid and substantial propositions to the core.

If we take as an example of a public service company in a great city the Commonwealth Edison Company of Chicago, for instance, some exceedingly interesting facts may be brought out bearing on the above point. The amount of coal consumed by this company per year is upward of one million tons; per day, upward of 2,800 tons; and upward of 120 tons per hour. The figures are stupendous—just consider what they mean to the industrial world at large. This company, in order to avoid any trouble from strikes, has to accumulate at times as much as 300,000 to 400,000 tons of coal in stock. To bring this more vividly before you, let it be suggested that the extra expenditure for fuel this year prior to April 1 amounted to about $300,000. To quote the president of the Commonwealth Edison Company in regard to this extra expenditure: "We have to do a thing like that from two points of view—our duty to our customers and our duty to ourselves, the owners of the property. The steam railroad trains can stop and stay at a point all winter, if necessary, due to accumulations of snow, a strike of the employes, or whatever unfavorable conditions Providence or man may bring about, and it is forgotten in a day. But just imagine what would happen to a community like Chicago if our service stopped. The wheels of industry would cease. The majority of the newspapers would cease to be printed. The post-office and the courts would have to shut down. In fact, most of those things which contribute either to the comfort or discomfort of modern civilization would have to come to a standstill. At this time we pay the city of Chicago $1,058,000 annually for taxes and municipal compensation. That amounts to $2,800 a day, $120 an hour, just about $2 a minute!"

It is decidedly interesting to note the amount of money contributed for public purposes. In 1889 the Commonwealth Edison Company contributed $6,000; in 1899 the sum was $27,700; and in 1911, $1,057,500 was contributed to the city in the form of taxes and municipal compensation. It might be remarked here that in

1911 the enormous sum of $1,591,100 was spent in fuel.

To continue the president's remarks: "In 1889 there was $797,200 invested in plant. That refers to generating and distributing stations. In 1899 the figure had reached to $17,461,000, and in 1911 the huge sum of $68,896,000 was so invested. And this investment is now growing at a rate of about five million dollars a year."

Whether you are greatly interested in figures or not, just consider what the foregoing means. It tells you a story of possibilities almost unique, not only in its own field, but in the great big world of financial accomplishment. And this story will undoubtedly be continued on into the future with just as startling disclosures of progress. You know, for instance, that much has already been done in the direction of electrification of steam railroads. What does this mean to the central stations where improvements will in the future be made? To quote again from the same authority:

"There is in Chicago an electrical zone about 32 miles long and from ten to twelve miles wide. Supposing the Vanderbilt roads all produced together in one group and the Pennsylvania roads in another group and the Harriman lines in yet another group, and so on all along the line. That is to say, suppose they took care of their own electrical production of energy. Then, on the other hand, suppose that the one great central station system, alluded to, produced the electrical energy, there would be a difference in the cost of the necessary investment at the start of easily $10,000,000. In a period of, say, ten to fifteen years, the difference in the amount of invested capital required would probably amount to $30,000,000."

We can pause here, for it marks the final point in the economy and efficiency of centralization. It means that if these railway companies wanted to go it alone, it would at the start cost them more than $10,000,000 more than if their power was supplied by the one great central station organization. And this is so forcibly brought to your attention to as strongly as possible impress upon you the necessity for all such consolidations, and the opportunity for the wise investor if he takes time by the forelock.

To carry the point a little further as to the future, of the total amount of business now possible in the Chicago community the Commonwealth Edison Company is supplying only about one-third, or a little more than one-third—possibly 35 per cent. It takes, in round numbers, about $75,000,000 to operate this business at the present time. If it were possible to get all the business possible to be obtained, it would more nearly take $250,000,000 to operate the business of manufacturing and distributing energy in all of Chicago and its vicinity.

There you have it. It is in the logical combinations of capital in public utilities, of which the above company is an example, that you find your future right before you for the possibilities of sound growth and immense growth are unlimited.

And on all this vast aggregation of capital, as stated once before, the investor may with safety net as high as five and seven per cent on the capital stock and 4¾ to 5¼ per cent on the bonds. What more could possibly be asked?

In 1889, to return to our example, the total income of the Commonwealth Edison Company from light and power and railway service was $105,700; in 1899 the income from the same source was $1,792,700; and in 1911 the income had reached $13,902,300. In 1893 the same company had 4,100 customers; in 1899 it had 13,300 customers, and in 1911. 157,115.

To turn to another company: It may be mentioned that the Doherty Operating Company, a company organized by the Henry L. Doherty and Co.'s interests, one of the best known in America, will operate the newly incorporated Consolidated Cities, Light, Power and Traction Company which in June of this year sold

$4,500,000 five per cent first lien bonds in London. Now it may be told that that sale was accomplished in a few hours. There are eleven plants in the new company's control and they operate in 21 cities throughout this country and Canada. And the point is that each property secured must come up to the Doherty standard of earnings and must be in a section of the country the past record of which is an assurance of its future growth. There again you have an illustration of the present trend of capital.

Taking at random from a long list of such undertakings, 70 of these public utility corporations, let us give an analysis of the gross earnings in the three years from 1908 to 1911, inclusive. Of the whole number, it is shown that 60 of these companies increased gross earnings, in 1908, 7 to 30 per cent over 1907; in the next year, 62 corporations made a gross gain of nearly 11.30 per cent over 1908; in 1910, 66 corporations increased gross earnings twelve per cent over 1909, and in 1911 70 corporations increased gross earnings 9.30 per cent over the previous year.

The 70 companies mentioned are composed of 25 electric railway corporations, 37 gas and electric light companies, five telephone companies and three water companies. No company shows less than $100,000 in gross earnings. The gross earnings for these companies in the last two years to December 31 were as follows:

Gross earnings, 1911.....	$266,954,444
Gross earnings, 1910.....	244,094,360
Increase in 1911	22,860,084

Percentage of increase, 9.30 per cent.

As a comment, it can be said that during the extreme period of depressions in 1893 to 1896, when over one-fourth of the railroad mileage of the country was placed in the hands of receivers, conservatively capitalized and well managed public utility companies in the larger cities, almost without exception, emerged in good condition and with the record of having promptly met all obligations. No possible severer test of the strength of the bonds of these companies as investments could be demanded than is shown by these facts.

Then we have before us the comparatively recent record of the panic of 1907. Public service corporations showed no shrinkage, but on the contrary continued to grow and increase by reason of the fact that they were supplying the public with something absolutely necessary to its mode of living.

One word more: At the time this goes into print, the stress of the general election will be more or less felt all over the country; feeling will run high, and there will be divers expressions of opinion as to the effect of the election on this or that class of investment. Money may usually be considered timid at such a time.

Do not be alarmed. There will be an active market for securities of all kinds, and the very time to get in and wisely place your money will be then, as now, for the public service corporations have nothing to fear. Rather the reverse, for the legislative aims of all parties are in the direction of proper control and therefore proper and adequate protection of such organizations, with a corresponding benefit and security to the owners of stock and holders of such securities.

NEW BOOKS

COMMERCIAL ENGINEERING FOR CENTRAL STATIONS. By Edmund F. Tweedy, New York: McGraw-Hill Book Company. 1912. 142 pages with 27 illustrations. Price, $2.50.

This is a compilation of facts and figures of value to the commercial departments of electric light and power companies of argumentative value to lay before prospective customers. It takes up such matters as cooling the air in buildings, mechanical refrigeration for the cold storage of furs, electricity in the modern department store, ozone and its production, kilowatt hour costs in steam driven generating plants, the passenger elevator in modern office building service, etc.

SCIENCE EXTRACTS FROM FOREIGN JOURNALS

NEW SOUND-PROOF TELEPHONE BOOTHS

Soundproof telephone booths are now constructed by a German firm, and owing to the new principle which is used in their makeup, it is said that not the least sound can escape from them while the telephone is being used. The walls of the new booth are built of five layers of thin wood, with the grain crossed each time, and the layers are glued together, and then the whole is covered with a special soundproof compound, so that in this way it is not required to use deadening cushions as a lining for the booth. As the whole is made in six dismountable panels, a booth can be set up in a very short time, and the panels are not too large to be taken in through an ordinary door. Insulated openings are left in the partitions beforehand, so that there is no need of boring holes in order to put in telephone or electric light wires.—*L'Electricien, Paris.*

TELEPHONE SERVICE IN PEKIN

A telephone service is now officially organized in Pekin. Two central exchanges have been installed in the city, and they are fitted up for 6,400 subscribers. What is to be noticed is that both the exchanges and lines are of home manufacture, and the Chinese government is engaged in operating the telephone system. There are already 3,000 subscribers in the Chinese and the Tartar quarters of town, and the rest of the city will be wired up in the same way before very long. In the part of town containing the foreign legations, where there were already quite a number of telephones in use, these are now connected by extending the wiring as far as the central exchanges.—*L'Electricien, Paris.*

FAMOUS CHURCH BELLS ELECTRICALLY TOLLED

The parish church on the Klosterstrasse, Berlin, with its famous 200 year old bells, is one of the best known in the city. Not long ago the bells were fitted with electric ringing apparatus. This ingenious device is the invention of a Cologne firm, and is already in use in some 30 churches in different parts of the country, among others the Limberg cathedral, where very heavy bells are set in motion. The special advantage of the new device is that it gives a two sided pull on the bells so that there is given a precise and uniform stroke of the hammer without any shaking or shocks.—*London Electrical Review.*

EXAMINING COAL WITH X-RAYS

Coal is now examined by the X-rays in order to see the quality of the substance which it contains. While pure coal is almost transparent to the rays, there can be seen differences between the various qualities of coal and even between different parts of the same specimen, so that the makeup of the coal can be noted in this way, and the amount of ash can be estimated. There are, in fact, two or three kinds of ash contained in coal—first, the foreign matter brought by wind and rain upon the wood of the forests which gave rise to the coal; then we also have the mineral matter forming part of all living plants, and again the products formed by the action of these various compounds upon each other. Examining the coal by the X-rays is likely to be very useful in the future in deciding what kind of impurities are contained in the coal and what its value is as fuel.—*Cosmos, Paris.*

ELECTRIC ORDERING DEVICE FOR RESTAURANTS

An electric waiter for hotels and restaurants is the invention of Mr. H. Quertier, and it is operated by the customer, who is in direct connection with the kitchen. On each table is a wood frame carrying a menu card, and opposite each item of the bill of fare is a button. Having chosen his dish, he presses the button and at once the number of the table and the order are displayed in the recorder in the kitchen, while an electric alarm bell rings to notify the cook. An apparatus in the kitchen automatically issues a ticket with the order details and price, and a duplicate is kept upon endless tape so as to have a check upon money and goods. When the electric printer drops the ticket into the tray, the order can be prepared and delivered with the ticket by the waiter girl at once. At Wellington, New Zealand, where it is used, the electric method has had much success.—*London Electrical Review.*

ELECTRIC STEEL PRODUCTION IN NORWAY

Electric steel production is on the increase in Norway, and two new companies have been formed for constructing plants of the kind. The first of these has a capital of about $1,000,000, and is arranging to secure about 3,000 horsepower from a local hydraulic station. It is to erect an electric steel furnace of a new design and a very complete works with rolling mill, steam hammers, foundry, and the like, so as to be able to produce over 3,000 tons of steel annually in the shape of rolled and cast steel. The second enterprise is a steel works near Arendal, and the current comes from the Boilejos falls at Nedelven. In both these plants the electric furnaces are of the type made by the Swedish electro-metallurgic firm. It is thought that the annual product from the two steel works will not be less than 15,000 tons.—*Industrie Electrique (Bi-monthly), Paris.*

DEATH OF HENRI POINCARÉ

Europe has met with a loss in the death of Henri Poincaré, who has been considered for many years past as the greatest living mathematician. His activities bore upon many branches of science, among which electrical theory was prominent. He was born at Nancy in 1854, and after passing through the Polytechnic School he subsequently became Professor at the Paris University, which position he has kept ever since. He was a member of the leading scientific bodies, such as the French Institute and the Academy of Sciences, and was also a member of many foreign scientific societies. He wrote a number of works upon the branches of heat, light, electricity and other questions, and was one of the leading spirits in the modern scientific movement. He was a cousin of Raymond Poincaré, the French Prime Minister.—*L'Electricien, Paris.*

SIR HIRAM MAXIM'S COLLISION PREVENTER

Sir Hiram Maxim, the well-known English inventor, is at work upon a new method for use with vessels at sea so as to be able to detect the presence of distant objects and thus avoid collisions. His idea is based upon the so-called sixth sense possessed by bats when flying in the dark, but here it is probable that there is no special sense in play, but the vibrations given by flapping the wings are reflected from walls and the like, and there seems to be a special organ in the head for observing the reflected waves so that the bat takes note of nearby objects. On the vessel a large steam siren would set up sound waves of such a low pitch that the ear would not perceive them. Such waves could travel many miles and be reflected back from icebergs or rocks, and the echo received on a large diaphragm on board. The vibrations of the diaphragm could then act to close the circuit of an electric bell so as to give the alarm.—*London Electrical Review.*

DETERMINING LONGITUDE BY WIRELESS

Several determinations of longitude have of late been made by means of wireless signals, but the most satisfactory attempt of this kind recently took place between Paris and Tunis. Wireless signals connected two clocks, one at the Eiffel Tower and the other at Bizerta, on the Mediterranean coast near Tunis, which is one of the leading French naval stations. Comparison of the two clocks gave the accurate figures for the longitude. The signals traveled the distance in 0.007 second, which works out at nearly 200,000 miles a second. When Sir George Airy, the British royal astronomer, determined the longitude of Valentia, the little island off the coast of Kerry, he had no fewer than 30 chronometers carried backwards and forwards between Valentia and Greenwich Observatory 22 times before he was satisfied.—*The Marconigraph, London.*

A NEW ROAD OVER THE ALPS

Referring to the new Lötschberg electric railroad which crosses the Alps, it is probable that the electric locomotive trams will commence to run in the spring of 1913. Tourists will welcome this event, as they will then see some of the most attractive Alpine scenery, for the new road is to take the first rank as to the beauty of the route, and the great tunnel adds to the interest. The new electric locomotives will be more powerful than any of the steam locomotives now in use, and are to make higher speeds than on the rival St. Gothard or Mount Cenis lines. In fact, two steam locomotives would be needed to take the international 340-ton trains up the steep grades, where one of the new electric locomotives will now do it. The entire length of the railroad is 45 miles, and it mounts up to a very high point in the Alps, then descends into the Rhone valley and connects with the Simplon line. Along the route is the new electric cable incline up to the lofty summit of the Niesen, and at another point is the Adelboden winter resort at Blue Lake. — *Revue Polytechnique, Switzerland.*

WIRELESS IN THE SOUTH SEAS

The German government has just granted a concession to the Telefunken and the German-Holland telegraph companies to build and operate two large wireless telegraph stations in the German colonies in the South Seas. The stations, which are to be laid out on the Telefunken system, will be located at Yap-Rabaul in New Guinea and Apia in Samoa, and will be valuable in making connections between leading points in the colonies, and also with the landing stations of telegraph cables. The two wireless stations will be equipped with the most recent high power apparatus, and will use about 120 horsepower. The steel towers are about 400 feet high. With the present stations it is expected to cover oversea distances of 2,500 miles.—*London Electrician.*

EXPLOSION OF RADIUM

An explosion of radium is a somewhat unusual occurrence, and this is fortunate, for it is likely to cause a severe accident. M. B. Jost, a German scientist, was working with radium bromide in connection with one of his detecting screens of the kind which lights up or shows sparkles where the active particles of the radium bombard it. He had taken up a very small grain of powerful radium composition on the point of a knife and brought it near the screen, when it exploded with some noise and sent showers of powder to all sides. Some of it struck the screen and caused a fine display of sparkles, but the powder also entered his eye and caused much inflammation, which was difficult to cure. An explosion of unconfined radium has not been observed before, and he thinks it is due to gas from the radium collecting inside the solid particle. Before this, however, a radium tube belonging to M. Precht exploded, and this was also due to the pressure of the gas.—*Cosmos, Paris.*

United States First in Communication Facilities

Hon. O. P. Austin, chief of the Bureau of Statistics, Department of Commerce and Labor, in a recent address, cited the fact that the United States stands first in facilities of communication. We have twice as many miles of telegraph as any other country of the world, and every city and factory of the country is within speaking distance of every continent and great trading center of the world. In the number of telephone messages sent the United States surpasses the total for all Europe combined.

What Horsepower Really Measures in Watts

The Bureau of Standards has just issued a bulletin on the kilowatt equivalent of horsepower. The most frequently quoted equivalent in watts until now has been 746. Since, however, the pound weight as a unit of force varies in value as the acceleration of gravity varies, the number of foot pounds per second in a horsepower accordingly varies with the latitude and altitude. It is equal to 550 foot pounds per second at 50 degrees latitude and sea level, approximately the location of London, where the original experiments were made by James Watt to determine the magnitude of the horsepower.

The Continental horsepower, which is used on the continent of Europe, differs from the English and American horsepower by more than one per cent. Its usual equivalent in watts is 736. This difference is due to the confusion which exists in the weights and measures of 100 years ago. The metric system soon placed the various values of the horsepower in terms of 75 kilogram meters per second, although the original English equivalent would be 76.041 kilogram meters per second.

Since a unit of power should represent the same rate of watts at all places, the Continental horsepower is best defined as 736 watts, which is equivalent to 75 kilogram meters per second at latitude 52 degrees 31 seconds. In the future 746 watts will be used as an exact equivalent of English and American horsepower.

A Giant That Knows No Mercy

Only those cool, self confident servants of science who take charge of our central generating stations know what terrific forces they are dealing with, and what the consequences of a single mistake will be. There is no quarter for these men, no time to draw back or to retrieve an error; the imprisoned giant knows no mercy, and with a single switch thrown in at the wrong moment, which inadvertently gives him a path of escape, he shakes off his bonds and wreaks havoc and destruction around him.

It is only when one has stood on the switchboard gallery of one of our large central stations in any of our big cities, and has been a principal actor in one of these shutdowns—as they are technically called—and has heard the vicious snap of a high tension short, and has smelled the never to be forgotten odor of copper reduced to its elemental gases, that one fully realizes the tremendous force we have at our disposal and the colossal impudence of man in daring to capture and train this mighty force as his slave.

"That get-rich-quick man is as busy as a bee."

"Yes," replied Mr. Cumrox. "He's one of those busy bees who can't manage to gather honey without incidentally stinging somebody."

* * *

Teacher—"Now that you have learned about the rhinoceros, can you tell me any other animal that has a horn and is dangerous to mankind?"

Pupil—"Please, yes—a automobile."

* * *

Knicker—"Which end of a cow gets up first?"

Butcher—"It all rises at once."

* * *

Frightened officer—"Stand till the last ditch, my brave men. Don't run until you have to. But as I am a trifle lame I—I think I will start now."

* * *

A belated automobilist, whose car got locomotor "attacksia" miles from anywhere at 2 a. m., knocked at the door of the only house in sight.

"Who's there?" asked a voice from the upper window.

"A traveler," was the reply.

"Then travel." And the window closed with a bang.

* * *

A man went to an insurance office to have his life insured the other day.

"Do you cycle?" the insurance agent asked.

"No," said the man.

"Do you motor?"

"No."

"Do you then, perhaps, fly?"

"No, no," said the applicant, laughing. "I have no dangerous——"

But the agent interrupted him, curtly. "Sorry, sir," he said, "but we no longer insure pedestrians."

* * *

Three-year-old Eleanor was given a dime as a reward for docility in taking a dose of medicine. The next day her elder brother offered her a nickel to pick up a basket of chips in his place. "Hm!" refused Eleanor, "I can make more than that taking castor oil."

Father ruefully gazed on his last shilling.

"Money has wings, and house rents make it fly," he said.

"Yes," said his 15-year-old son, "and some houses have wings, for I've seen many a house fly."

"You're smarter than your old dad, maybe, my son, but I always thought that no part of a house except the chimney flue!"

* * *

Love has been described as "an inward indescribability of an outward all-over-ishness for a girl."

* * *

The only thing that could be worse than a toothache and earache at the same time would be rheumatism and Saint Vitus' dance.

* * *

A very pretty but extremely slender girl entered a street car and managed to seat herself in a very narrow space between two men. Presently a portly colored mammy entered the car and the pretty miss, thinking to humiliate the men for their lack of gallantry, arose.

"Aunty," she said, with a wave of her hand toward the place she had just vacated, "take my seat."

"Thank you, missy," replied the colored woman, smiling broadly, "but which gen'man's lap was you sittin' on?"

* * *

Mr. Wise—What would you do for me if I'd give you something to eat?

Willie Wantajob—I can saw some wood for you.

Mr. Wise—I have no wood; we do all our cooking by electricity.

Willie Wantajob—Well, you could let me turn on the electricity.

* * *

The First Burglar—Wot abaht the bloomin' burglar alarm?

Second Burglar—May as well put it in the bag, we can get something for the bells, p'raps.

* * *

"Is there anything you can do better than any one else?"

"Yes," replied the small boy, "I kin read my own writing."

IT TAKES A SCIENTIFIC GUY TO RUN A FARM NOWADAYS
GREASE SPOT
TO MAKE A BALKY HORSE GO WRAP A LIVE LIGHTING WIRE AROUND HIM — HE WILL SOON BE GONE
YE OLD COW
YE OLD WELL
MOTOR DRIVEN MIXING PUMP
MILK
BULL GOOSE
"ONE YEAR AGO I STARTED CULTIVATING THEM WITH AN ELECTRIC COMB — NOW MY SPINACH CROP IS THE BEST IN THE COUNTY"
"SINCE IVE BEEN USING ELECTRICITY ON IT MY CORN IS LARGER & FINER THAN EVER"
"THE CURFEW TOLLS THE KNELL OF PARTING DAY - THE LOWING HERDS WIND SLOWLY O'ER THE LEA" OR SOME THING LIKE THAT
LOW
LOW LOW
"VERY LIKELY I'M SPRAYING THIS TREE WITH ELECTRIC JUICE"
DRAMATIC DEPARTMENT
THIS OLD FAVORITE IS REPRINTED BY REQUEST — THE ELECTRIC LIGHT PLANT
ELECTRIC COW BELL - INVENTED BY ROY BROWN - - - -
MISS HOOZISS THE FAMOUS ACTRESS ON HER ELECTRIC FARM SPRAYING THE WATER MELON TREE
THE JUDGE
MAUDE MULLER ON A SUMMER DAY RAKED THE MEADOW SWEET WITH HAY
TASTY CHICKEN SANDWICHES

Common Electrical Terms Defined

In this age of electricity everyone should be versed in its phraseology. By studying this page from month to month a working knowledge of the most commonly employed electrical terms may be obtained.

STRAIN INSULATOR.—A form of insulator inserted in the guy wires of a trolley line or at the ends of the antenna of a wireless aerial.

STRAY FIELD.—The lines of force from the field poles of a dynamo or motor through which the wires of the armature do not pass, these lines being scattered and wasted.

STRAY POWER.—The energy lost in driving a dynamo, due to friction windage, etc.

STRIKING DISTANCE.—The space between two conductors at which a spark just begins to jump across.

SUB-STATION.—An electric plant receiving current from a main generating plant some distance away, and designed to supply consumers in the immediate neighborhood.

SULPHATING.—The formation of a coating of sulphate of lead upon the plates of a storage battery.

SWITCHBOARD.—A board usually of slate or marble upon which are switches, voltmeters, ammeters, etc., for opening and closing circuits connected to it and for measuring the voltage and current. The board may be a center of electrical distribution for a plant, station, building, etc.

S. W. G.—Abbreviation for Standard Wire Gauge.

SWINGING GROUND.—A ground upon a telegraph or other electric circuit in which the connection to earth is intermittent, usually due to wind blowing the wire.

TACHOMETER.—An instrument for finding at any instant the number of revolutions per minute of a shaft. The readings are read directly from a dial.

TANGENT GALVANOMETER. — (See Galvanometer.)

TEAZER.—A coil of fine wire wound on the field magnets of a dynamo and connected in shunt across the main circuit.

TELEGRAM.—A message sent by telegraph.

TELEGRAPH KEY.—A pivoted metal lever with a finger rest, used to close and open a telegraph circuit by pressing or releasing the lever.

TELEPHONE.—An apparatus for the transmission of speech by the use of electric current.

TELEPHONE EXCHANGE.—An office in which are centered the lines of a number of telephone subscribers, these lines being so arranged on a switchboard that any subscriber may be placed in communication with any other.

TERMINAL.—A name applied to the end of an electrical conductor and sometimes to the poles of a battery.

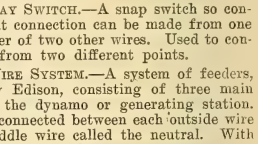
TERMINAL VOLTAGE.—The voltage of an electric generator at the point where the feed wires are connected to it.

TESLA COIL.—An induction coil for giving a high voltage and high frequency. It consists of a primary coil of only a few turns connected to the secondary of a spark coil, a spark gap and condenser in parallel across the connecting wires, and a secondary coil of fine wire.

THERMO-ELECTRIC PILE.—In 1822 Seebeck found that a current may be produced in a closed circuit by heating a point of contact of two dissimilar metals, such as bismuth and antimony. A number of pairs of these metals joined together form a thermo-electric pile, which is a valuable instrument in detecting differences of temperature by a galvanometer placed in the circuit.

THREE WAY SWITCH.—A snap switch so constructed that connection can be made from one wire to either of two other wires. Used to control lights from two different points.

THREE WIRE SYSTEM.—A system of feeders, invented by Edison, consisting of three main wires from the dynamo or generating station. Lamps are connected between each outside wire and the middle wire called the neutral. With lamps equally divided between the two sides no current flows through the neutral. With all the lamps on one side of the neutral wire all the current goes through the neutral. (See cut.)



Three Wire System

TICKER. — A telegraph instrument for automatically printing information regarding stock, baseball, etc., upon a paper tape. Subscribers for these devices are stock and grain brokers, clubs and persons desiring to be kept in close touch with this kind of information.

TORQUE.—The turning force which acts upon or is exerted by the armature of a dynamo or motor.

TRANSFORMER.—A device used on alternating current to step the voltage up or down. The apparatus consists of a primary and a secondary coil wound upon a soft iron core.

TROLLEY.—A rolling metal wheel that runs on an overhead wire, taking current off for operating an electric car.

TRUNK LINES.—The lines in a telephone exchange connecting different sections of the switchboard or running between exchanges.

TURNS.—Applied to the windings of a wire about a solenoid, electro-magnet or like apparatus. A wire wound six times about a bar is said to contain six turns.

POPULAR ELECTRICITY MAGAZINE

In Plain English

HENRY WALTER YOUNG, Editor

Vol. V | **November, 1912** | **No. 7**

CONTENTS

	Page
EDISON AS A MANUFACTURER	625
First Quartz Lamp Installation in the United States	635
Paris Fire Fighters	636
Static Electricity Fogs Films	636
Professor Moissan's Furnace	637
Lighting the Track Ahead	637
AN IDEAL CENTRAL STATION PLANT	638
Mill Mountain Incline	643
Loud Speaking Telephone for the Home	643
Shooting at Moving Pictures	644
London's "Human Spiders"	645
Electric Heating in Sweden	646
Efficient Plan for Canvassing Election Returns	646
Light for the Sultan of Lahej	647
ELECTRICAL INVENTION AND A LARGER PATENT OFFICE	648
Novel X-ray Apparatus	652
Quartz Working	653
Street Car Efficiency in Germany	653
Why Conduits Are Necessary in the Philippines	654
Wind Mill Farm Lighting Plants	655
Electric Propulsion for Lake Boat	656
French Water Sterilizer	656
Testing Gun Carriages at the Krupp Works	657
Electricity Creator and Destroyer	657
Circular Railway Up Mount Washington	658
An Electric Heater for the Cabin	659
SIR JOSEPH BEECHAM COMMENTS ON ENGLISH ELECTRICAL AFFAIRS	660
Most Powerful Merchant Ship Searchlight	662
What is Electricity?	663
A Greenback Laundry	663
Ice Harvesting on the Farm	664
Saving Lamp Carbon Stubs	664
ELECTRICITY IN THE CONTROL OF FIREWORKS DISPLAYS	665
Dictating Letters by Telephone	668
The Location of Electric Heaters	668
Destroying the Brown-tail and Gypsy Moths	669
Linking the Links of the Long Distance 'Phone	670
Picture Lighting without Glare	672
Illumination of Niagara Falls	673
Electric Thermometer	673
A Cold Storage Plant for Furs	674
A BLACK ART ENTERTAINMENT	676
Electric Heater for Face Steaming	679
Electricity and Oil	679
Thirtieth Anniversary of Electric Lighting in New York	680
THE MAKING OF AN ENGINEER	682
Foreign Delegates at American Conventions	684
Telephone Attachment	684
Glaciers Transformed into Electrical Energy	685
Telephones in Jerusalem	685
Electric Current Dries Dyed	686
Electrically Illuminated Waterplane	687
Canal Boats Propelled by Electricity	687
Electric Current at Work	
Electric Wood Sawing Machine	688
Telephone for Motor Cars	688
Furnace Gas Analyzer	689
Rectifying Nets	689
Physician's Electric Cabinet	690
Cut-Out Hanger for Arc Lamp	690
The Stannos Wiring System	691
The Periodograph	691
An Electric Tug Boat	692
Incandescent Lamp as a Heating Element	693
Adjustable Reflector	693
Mine Alarm	693
Wireless Picture Sending	693
Adaptable Lamp Stand	694
Magna Lamp Adjuster	694
Effective Night Billboard Lighting	694
Electrically Controlled Flashlight Device	694
Paper Drill with Adjustable Table	695
Portable Flashlight Apparatus	695
Electrical Men of the Times (Victor H. Tousley)	696
Electrical Interests of Women	
Electricity as an Aid to Health	697
Illuminating the Thermometer	697
Electrical Shops and Shopping	698
Quad Electric Stove and Fireless Cooker	699
WOMEN WHO DRIVE THE ELECTRIC CAR	699
The First Thanksgiving Week	702
Electricity in German Homes	702
ELECTRIC COOKING IN A MODERN HOTEL	704
Triscuits Baked by Electricity	705
For the Toastove	705
Junior Section	
THE BUFF COCHINS AND THE BATTERY	706
As an American Boy Sees Switzerland	708
Electric Fly Killer	709
Door Alarm	710
Fairyland Discovered	710
Electric Lighting in Arabia	711
Popular Electricity Wireless Club	
A WORLD WIRELESS SYSTEM FOR UNCLE SAM'S NAVY	712
Field Mast for Wireless and Searchlights	715
Proposed Atlantic Weather Bureau	715
A German Wireless Motor Car	716
Frenchman Invents New Detector	717
Great Brazilian Wireless System	718
Knapsack Wireless Outfit	718
Wireless Antenna for Balloons	718
HOW TO COMPLY WITH THE NEW WIRELESS LAW	719
Wireless Club Directory	724
For Practical Electrical Workers	
WIRING IN DAMP PLACES	726
Strain Insulators	728
Tool for Forming Wire Joints	728
Lighter for Auto-Gas Headlights	729
Capacity of a Lifting Magnet	729
Show Case Signs	729
Open Door Alarm	729
Collapsible Contact Maker	730
To Make a Simple One-Way Telephone	730
Supporting Open Wiring in Concrete Building	730
Light for Rows of Shelves	731
Service Switch Closes Burglar Alarm Circuit	731
Indicating Push Buttons	732
Ice Box Drip Pan Alarm	732
Tapping Individual Lights from the Switch Cabinet	732
Drop Light Counter-Balance	733
Keeping the Motorman Warm	733
Convenience in House Wiring	733
Adjustable Work Bench Fixture	734
A Trade Winning Show Brush	734
Miniature Elevator Display Shows	735
Moving Headlight as a Window Attraction	735
Testing a Typewriter in a Window	735
Invisible Multiple Rotary for Window	736
Demonstrating Gasoline Auto Trucks	736
Trophy Fixture	736
Miscellaneous	
THE MAGNET	737
Getting Ready for the Opportunity	739
Utilizing an Out-of-the-way Corner for Effective Display Space Advertising	740
Dr. Eyde's Work in Electrical Production of Nitrogen	741
ELECTRICAL SECURITIES	742
New Way of Using Radium	745
Electrical Heaters for Church Pews	745
St. Elmo's Fire	745
New Way of Making Quartz Tube Lamps	746
Human Compass	746
Electric Timing at the Olympic Games	746
Telephones per Capita in Scandinavian Countries	747
International Congress of Electriculture	747
Gasoline-Electric Omnibus in London	747
Long Distance Wireless Record from Persia	747
Map Making with the Aid of Wireless	748
New Books	748
Edison Among the Great Manufacturers	749
Neon and Electric Waves	749
Short Circuits	750
Common Electrical Terms Defined	752

RENEWALS When your subscription expires, you will find a renewal blank enclosed here. You should fill out and return with remittance at once to avoid missing a number. Positively no copies will be mailed on any subscription after same expires unless renewed, and we cannot agree to begin subscriptions with back numbers. The date on wrapper of your magazine shows issue with which your subscription ends. The extension on this date to period covered by renewal is sufficient receipt. If any other is desired it should be requested at time of renewal.

CHANGE OF ADDRESS Notify us promptly of any change in your address, giving both the old and new location. Since our mailing list for each issue closes the 5th of the preceding month (i. e., list for February closes January 5th), changes received after the 5th must necessarily take effect with issue for second month following. Postmaster as well as Publisher should always be notified of changes in order to forward mail sent to old address.

ISSUED MONTHLY BY POPULAR ELECTRICITY PUBLISHING CO., Commercial Bldg., Chicago, Ill.

YEARLY SUBSCRIPTION, $1.50; CANADIAN, $1.85; FOREIGN, $2.25; SINGLE COPY, 15 CENTS

No additional copies will be sent after expiration of subscription except upon renewal.

Entered as Second Class Matter April 14, 1908, at the Post Office at Chicago. Under Act of March 3, 1879.

Copyright 1912, by Popular Electricity Publishing Co.

MAHOGANY DESKS ARE CONSPICUOUS BY THEIR ABSENCE AROUND THE EDISON OFFICES. THE ONLY FINELY FURNISHED OFFICE IN THE PLACE IS THE LIBRARY OF MR. EDISON, AND "HE'S ONLY THERE WHEN HE SIGNS CHECKS" AS HIS MEN SAY

PUBLIC SERVICE TECHNICAL LIBRARY
NEWARK, N. J.

Popular Electricity
In Plain English

VOL. V NOVEMBER, 1912 No. 7

Edison as a Manufacturer

By H. Bedford-Jones

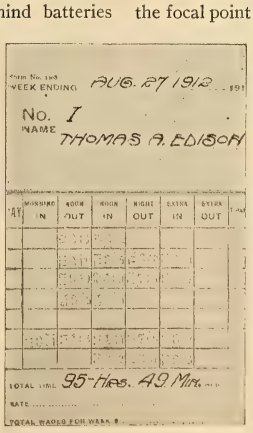
To dream dreams is very easy. To materialize the dreams of others is very easy. But he is the really great man who can turn his own dreams into hard, practical *power*.

The average inventor thinks his executive ability is one hundred plus. Give him a chance to prove it and he is apt to send out the S. O. S. call. But a few dreamers have been able to switch the surplus energy of their mind batteries into making good in a practical way. And the greatest of these is Edison.

Thomas Alva Edison is the representative of the highest type of American business man. This type is a composite of inventive, salesmanship and executive ability. Class B men must specialize in details. The Class A man specializes in the handling of men. Orange, N. J., is chock full of both detail-handlers and men-handlers.

The keynote of the Class A business man of today was formulated years back by one Dave Crockett. "Be sure you're right, then go ahead." Dave did not say "Be sure you think you're right," as a good many people imagine. You can easily think you're right, but *being* right is often a harder job than the going ahead. Being right is the principle which has placed Edison in the van of American manufacturers.

The Thomas A. Edison Company is the focal point of a dozen immense organizations. Each separate company is a direct product, not only of "The Old Man's" invention, but of his executive ability. One wonders at his ingenuity; one is appalled at his tremendous power of management. Outside the gate of the Thomas A. Edison, Inc., plant are listed the Edison Manufacturing Company, the Edison Phonograph Works, the New Jersey Patent Company, the Edison Storage Battery Company, the Edison Portland Cement Company, the Motion Pictures Patent Company, and as many more companies.


Form No. 143
WEEK ENDING AUG. 27 1912 191
No. 1
NAME THOMAS A. EDISON

DAY	MORNING IN	MORN OUT	NOON IN	NIGHT OUT	EXTRA IN	EXTRA OUT	Total

TOTAL TIME 95 Hrs. 49 Min.
RATE
TOTAL WAGES FOR WEEK $

EDISON'S TIME CARD. NOTE THE TIME IN ONE WEEK—OVER 95 HOURS

Storage Battery Works | Laboratory | Executive Offices | Cylinder and Disk Record Factory | Phonograph and Motion Picture Works | Concrete Cabinet Works | Small Motor and Rectifier Factory | Power Plant

FACTORIES, LABORATORIES AND OFFICES OF THOMAS A. EDISON, INC., ORANGE, N. J.

The dreams and the organizations of Edison are realized at Orange—a group of solid gray concrete buildings interspersed with others of red. Here is no usual type of factory. The two great facts which impress the visitor are first, lack of stability, and second, solidity. This is like no other factory in the world. The place reflects its master genius. The lesser genii must use their brains—and keep moving toward a fixed end which is continually placed farther on.

The average manufacturer mistakes stability for solidity. Edison never stands still, nor do his works. No product of his ever reaches perfection. "Be sure you're right," he says. Time after time some product seems ready for the market, only to be recalled for more improvements, more slight changes which will affect it in the years to come. The result is that through its very lack of stability this greatest of factories is imposing in its solidity. Nothing is a crime here save negligence.

More and more was this impressed on me as I went through the great shops and heard how problem after problem had been solved. On the famous storage battery, 50,000 distinct experiments were made and tabulated. Edison products contain nothing, can be associated with nothing, unless that thing is *right,* in every sense of the word. Just now Edison is working on a light delivery wagon, carrying a 20 volt motor, with a battery of sixteen 300 ampere-hour cells, running 45 miles per charge. Near Orange is a fifteen mile road, the worst in the country. A wagon good for 50,000 miles on an ordinary road goes to pieces after 250 miles of this one. Edison's wagon must run 2,000 miles continuously on this road—without a single accident. So far half a dozen wagons have been built in vain, and some $35,000 expended; the work may not be half done, but in the end a wagon will stand the test—and then have to stand a harder one. Then, perhaps, Edison will be satisfied and the world will have a new product.

But this, you say, is inventing, not manufacturing! Wrong. Mr. Edison knows how to invent, and applies the knowledge to manufacturing methods. Like most master minds of business, he invariably picks out the obvious things which others overlook.

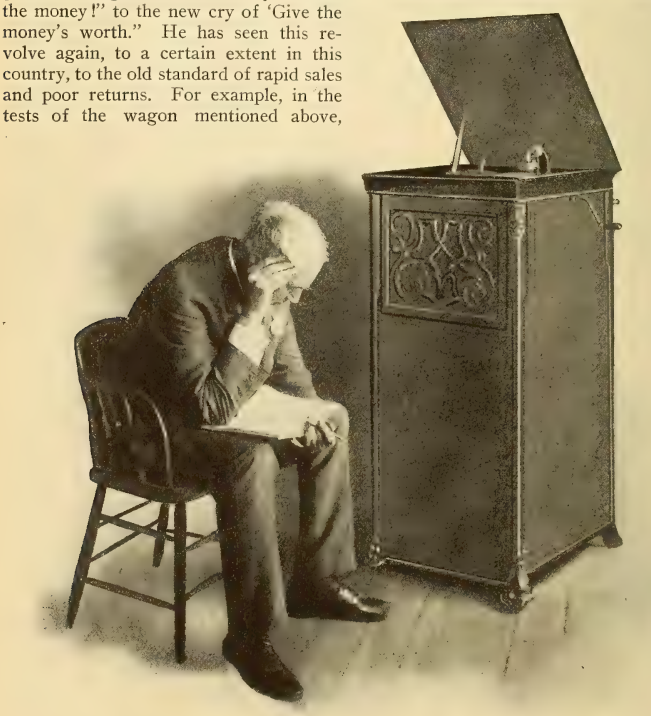
I was asking him about the patent reform question, on which a committee of Congress is now working.

"Simple," he said quickly and positively, with that manner of his which leaves no loophole for argument. "At present the burden of proof rests on the patentee. Make it rest on the infringer and the problem is solved. In other words, instead of making me prove that my patent has been infringed, make the other fellow prove that my patent has not been infringed. It is simpler, would avoid the endless lawsuits and the burden of proof would lie where it belongs. If the other fellow's patent is worth anything he would be spending his money to some purpose. If it is an infringement, the real inventor should not have to pay good money to prove it. This, moreover, would protect the penniless inventor from having his patents stolen. At present he cannot help himself unless he has the money to put up for legal costs."

It is these obvious things which are so hard to see. It is always easy for us to see just beyond our noses; we are blind to what lies under our noses. Mr. Edison went on to say that the greatest fault with the present patent situation lay in its method of settlement.

"It is fair neither to the inventors nor to the judiciary," he declared, "that an involved and intricate mechanical or electrical case should be decided by judges and juries who are not trained mechanicians or electricians. Yet such cases are decided every day by such men. It would be far better to let such things go before trained experts. The government employs these experts in other lines; why not in this? And a sufficient salary would place them above the temptation of bribery."

The world, in a way, has long been unfair to Edison, in not giving him credit for all his achievements. His ability as an executive has been overshadowed by his ability as an inventor. His power of salesmanship has been lost in the world's view of the "wizard." In his lifetime he has seen the evolution and devolution of business standards. He has seen the gradual change from the old cry of "Get the money!" to the new cry of 'Give the money's worth." He has seen this revolve again, to a certain extent in this country, to the old standard of rapid sales and poor returns. For example, in the tests of the wagon mentioned above, various motors from many of the largest American shops were tried and tested thoroughly. Invariably these motors were lacking in practical efficiency, and at length he had to build one himself. This is a startling statement, but it is true. And yet, from the day he became a manufacturer, Edison has maintained one watchword for all his men, in each of his shops. "Negligence is crime. Give



MR. EDISON IN CHARACTERISTIC ATTITUDE WHEN TESTING RECORDS

(From a photograph taken especially for Popular Electricity Magazine.)

Note the book in which he jots down various comments on quality, volume, surface or "scratch," and criticisms of voice and accompaniment. Some of these are interesting and amusing. One in particular reads: "The manner in which the accompaniment has burst forth in the introduction, compared with the thin, piping voice of the singer, is like announcing the singing mouse by roaring cannon."

a dollar's value for a dollar!" And in the effort to do this, he has had to give several dollar's value for a dollar—but it pays.

We were sitting before the new Edison disk machine, listening to the finest phonographic records ever evolved, when Mr. Edison touched on this point—Edison the manufacturer, not Edison the inventor. At one side an expert was inspecting record molds through a microscope, going over each inch of the three miles the needle travels, searching for blowholes or other defects. I heard how the reproducers had been tested for three years, how 2,500 combinations had been tried before the perfect one was found.

"And this absolute perfection," I asked, "does it pay in the end? Will not the rapidity of modern improvement cause it to go out of date quickly? Surely an earlier one of those 2,500 combinations was practically as good as this final one."

"Not on your life," came the almost savage reply. "I am not building for a day. The trouble with some American manufacturers is just that very point. They cater to the passing whim. I haven't finished with those records for that instrument yet; when I have, they will be perfect in every way. As it is, they are indestructible—as good five years hence as they are right now. We won't know the ultimate limits of that storage battery for years to come; it hasn't been invented long enough. But I do know it will show full rated capacity at the end of four years and am guaranteeing it. It pays to make things slowly, but to make them right. Over in Europe they do this much more than we do. It is one of the fundamentals of business success—not measured by success standards of today, but by those of a century hence. There are no 'seconds' or 'thirds' going out of my shops. Nothing but firsts, first, last and all the time."

Isn't that a mighty good "gospel of efficiency?" Thoroughness to the last detail is the watchword in Orange. Edison rejects absolutely everything which is not proved exact to the last fraction of an inch. He attends to details himself, suggests new machines, sees that they are made as he wishes, watches the tests himself. It is the greatest ambition of every employé in his shops to have a bit of "new work" approved by the "Old Man." Soon after this article appears the new phonograph will be on the market. The final records for that machine are now being tested individually by Mr. Edison himself. He listens to each one and accepts or rejects it with an ear for minute flaws not only in the construction but in the music. Many of our most "popular" and famous singers have been rejected by him. His singers must be up to his standard of efficiency; he cares nothing for the whims of today.

"People may think some of those people are great singers," he chuckled, as we listened to a marvelous but hitherto unknown soprano, "but they can't fool my phonograph! I've got 'em!" And he has. One famous violinist made a number of records, and Edison quietly rejected them one after the other. The artist was highly indignant and demanded his reasons.

"Aren't good enough for me," came the reply. "Bad music. Hear those harmonics? They don't sound in the concert hall, but when they come out of that hole, they do."

The artist listened, admitted there was a fault, and was at a loss to account for it. So Mr. Edison took the violin and placed the strings under a high power microscope. He was looking for the reason and he found it. The almost indefinable harmonics were produced by the strings which had been worn perfectly flat by the bow. This accidental discovery not only surprised the artist, but the manufacturer himself. It was never hitherto known that violin strings are worn to an exact flatness, even when comparatively fresh.

A month or two after you read this look for the new catalogue of the Edison disk records. The first 500 of these rec-

ONE OF EDISON'S LATEST GIFTS TO THE WORLD—THE KINETOSCOPE FOR THE HOME. EACH FILM CARRIES THREE SERIES OF PICTURES

ords will have been made by Mr. Edison personally, and put through the final tests by him. He has personally supervised the catalog itself, together with the artists represented. His agents throughout the world have been reporting on singers, famous or not, and sending records of the voices. Each voice met with the acid Edison test of quality. Each record on the catalog is approved by the keenest and most critical ear in the world. And with it all, hundreds of experiments have been personally conducted and countless details thought out every day.

The shops, of course, are under military discipline. No one can enter or leave without a pass. The visitor is surprised when he enters one of the offices of the departmental managers or chiefs. In all other such establishments are elaborate suites of private offices and passing guardians are found in proceeding from one luxurious room to another. One can hardly believe that none of these adjuncts exist here. There is no ostentatious display, no useless room. Mahogany desks are conspicuous by their absence. The only finely furnished office in the place is the library of Mr. Edison, and "he's only there when he signs checks," as his men say.

The reason for this? It is two-fold. First, the managers and department chiefs are men like Edison himself—practical workmen who spend more time in the shops than at the desk. Like all Class A business men, he surrounds himself with the best men procurable, men who, under anyone else, would be more remarkable than their masters. Many of them are almost as full of inventions as Edison himself. One of these, talking with Mr. Edison and me at 1 a. m., in the laboratory, began writing steadily for some time. He finished, and handed the pad to Mr. Edison. The latter read it, signed as a witness, objected to a minor detail—and his opinion was promptly overruled. In that few moments was born a new invention; within the next few years it will have been tested to the breaking point, and may then go to the market or the scrap heap.

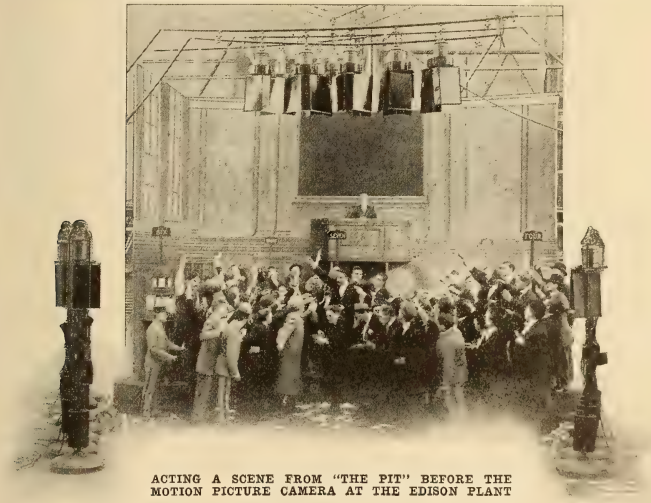
The second reason for the lack of fine offices is more involved. At the same time it has more to do with Edison the manufacturer. I came upon it by chance through asking the master genius a question aimed at his executive knowledge of his shops.

"In such a combination of industries," I asked, "is there not a danger point reached by your producers and non-producers? In other words does the overhead expense, red tape, and lost motion result in a higher manufacturing cost than where the business is smaller?"

"Exactly." "The Old Man" reached down for his tobacco meditatively, his eyes wrinkling. "But not here. The overhead expense, in which I would include the office force and other non-producers, is always on the jump. But so are your producers. One jumps ahead and catches up with the other, then the other takes a jump ahead, and so on. You simply must keep the two balanced. A small manufacturer is liable to disaster unless he can do this. He is apt to make the mistake of crowding his warehouse full, then shutting down his shop and selling his stuff. He doesn't build for tomorrow. The bigger your business, the less your overhead expense should be in proportion to your amount of production. Should be, mind—not *is*. Such a theoretical condition is nearly always impossible in practice.

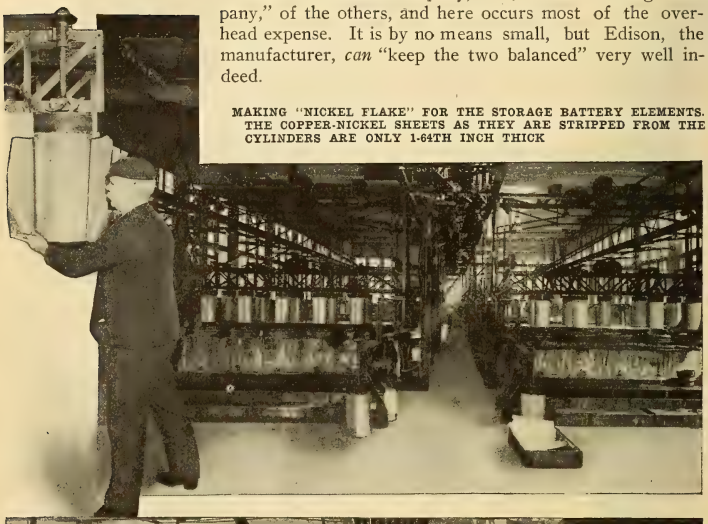
"Most folks want things to look well. I want results. For a good many years after I started in business I worked on the 'two hook' method. I had two hooks along side my desk. On one hook I stuck all bills payable, on the other all bills receivable. Then I had a checkbook to tell me how much I had in the bank. Those were all the books I needed. The more space you give to your non-producers the less you have for your producers. Floor-space is valuable."

Of course, the "two hook" method has not lasted to the present day, but the office forces here are small, considering



ACTING A SCENE FROM "THE PIT" BEFORE THE MOTION PICTURE CAMERA AT THE EDISON PLANT

the size of the industry, and are located centrally. The Thomas A. Edison Company, Inc., is the "holding company," of the others, and here occurs most of the overhead expense. It is by no means small, but Edison, the manufacturer, *can* "keep the two balanced" very well indeed.



MAKING "NICKEL FLAKE" FOR THE STORAGE BATTERY ELEMENTS. THE COPPER-NICKEL SHEETS AS THEY ARE STRIPPED FROM THE CYLINDERS ARE ONLY 1-64TH INCH THICK

ONE END OF THE FORMING ROOM IN THE STORAGE BATTERY PLANT. NO EXHAUST FANS OR VENTILATORS HERE SINCE THE GASES FROM THE EDISON CELLS ARE ODORLESS AND HARMLESS

Here I ventured timidly into politics—very carefully, for I knew nothing whatever of Edison's views on the subject.

"You have a combination of interests here yourself," I put forth, "and I would like to know how you view the question. Should eggs be unscrambled?"

"That depends on just how rotten the eggs are," came the answer. "I think a business combination should be regulated, not busted; or rather that its prices should be regulated. But not from the top. The only sound way to regulate prices is from the bottom upwards, not from the top downwards, as is advocated generally. In fact, it would be mighty hard to regulate prices from the top, with any efficiency, and you can't regulate them very far from the bottom. But you can regulate them *at* the bottom. My plan would be to take the average cost of production of any given product, figured from the mean cost of differing localities and methods used, and on this average cost to base the *minimum* selling price of the product itself. Let competition, in other words, figure on the maximum price, but let regulation figure on the minimum price. It is not the maximum price which kills a firm, but the minimum. Such a plan would effectually prevent destructive price cutting, which has sent so many concerns to the wall. An average minimum price, giving a fair profit to all, is the only fair regulation. To try to regulate it from the top is folly; it is like giving a man headache powders for sore feet—and would have about the same result."

On the subject of taxation Mr. Edison was equally stringent in his views. Some little time since, a number of men in France put up a proposition to him by which they were to manufacture certain of his products in that country. Over there the government taxes the stock of firms and companies, and in order to get around it, what is known as "founder's shares" are issued. This was carefully explained to Mr. Edison and the number of founder's shares to be given him was just being discussed when he cut the subject short with a negative decision. His reasons for this were simple.

"Did they touch any company of mine? I guess not! Why, it was a straight fraud game—cutting the government out of its lawful taxes! Too dirty to touch my hands, anyhow. No, sir, I believe in paying taxes fairly and squarely. If I'm living under the laws I intend to keep them—not keep the letter of the law only, either. If I don't want to obey them I'll get out. I want to be able to look every dollar I possess squarely in the face, and not have to blush when I do it."

As is well known, Mr. Edison himself works for days at a stretch, and many of his helpers do likewise. At these times he will take a nap on a work bench, and when he is "on the job" you can find more than one bench or table occupied by recumbent forms. Each group of assistants is working on some campaign, and the last finished of these and the most interesting to visitors is the model "suburban home."

This is a house in the Park near the factories. The house was rented and fully furnished, and was then equipped with the lighting system which can be installed at moderate cost in any home. Here may be seen electrical devices of every imaginable description. These are operated by a small group of cells in the basement and a small engine outside the house proper. The entire affair exhibits the salesmanship of Edison the manufacturer to a remarkable degree.

The single group of cells can be installed in any farmhouse and can be recharged by the engine, which need run only some seven hours per week. This is Edison's latest gift, a gift to the farmer, bringing within his reach the greatest attainments of civilization. By means of this he may operate everything from a washing machine to a foot warmer by his own power. Here may be seen the kinetoscope for the home—a complete moving picture machine which bears on each film

reel *three* series of pictures, reversible at will, and which is probably the finest educational factor ever placed on the market.

But even the kinetoscope reflects the lack of stability I mentioned above—as well as the solidity. Complete as it is, it may be touched upon at any time and re-made, minute changes added which the average person would never see, but which in the end will render it a thing unimprovable. For ten years Mr. Edison dropped all work on his phonograph, while perfecting the storage battery. Then he began his recently finished "campaign," worked steadily on it for three years, and today the instrument is perfect as never before — solidity through very lack of stability.

A FEW OF THE EDISON MEDALS. IT IS SAID THERE ARE SEVERAL QUARTS MORE PUT AWAY SOMEWHERE

A word on this machine may be of interest. It is founded on the simple principle that sound waves lose their tone and volume by taking a zigzag course from reproducer to vent, as in other machines; while by eliminating these side thrusts and substituting for them a rising and falling motion, the tone and volume is retained. With this machine all scratching is absolutely nil—but it required 2500 experiments on the diaphragm alone.

The shafts and bushings of the instrument are ground and gauged to within one-fifth of a thousandth of an inch. Each machine is tested, almost incredibly, and is furnished with an automatic stop which will check the record at any given point. The records themselves play from four to eight minutes—in itself a tremendous achievement.

One of the most interesting of Mr. Edison's late inventions is in use in the model house referred to above. This is an automatic voltage regulator which controls the pressure on all the lamps in a building. It can be placed anywhere in the basement, requiring no attention whatever, renders it possible to run the lamps while charging the home battery, and prevents burning out of lamps from voltage fluctuation.

This machine is operated by a solenoid, which opens and closes the circuit on a motor. This motor (through a worm drive) operates an arm which travels through a series of steps. This arm makes contact on the steps, cutting out and cutting in resistance according to the number of lamps or appliances in use, controlling a current of 30 volts to each. This invention was planned by Mr. Edison while on a train from Chicago. He brought 50 sketches into the shops and directed them to be worked out. One or two of them seemed better than the others, but each one was carefully tested until the final result reached perfection.

The atmosphere of the whole giant factory breathes *work*. Every such place has an atmosphere of its own, and this at Orange reflects that of its maker. There is no regard for appearances, only for results. Nothing is stationary; you may hear pianos in the laboratory or see scenario settings in the storage battery yard. Today there are 100 men at work

on a certain part of the storage battery. When this article appears there will be only three men—but new machines. Eighteen months ago the output of batteries was 700 a week; when this article appears the output will be 1800 a week. So it goes throughout all the Edison factories. You realize that they are in truth, factories, and that there is a factor behind them, a man of dynamic energy, whose personality is injected into and through them all ceaselessly, and whose message is drilled into man and machine alike, not for today, but for a century hence—"Be sure you're *right*. Then go ahead."

FIRST QUARTZ LAMP INSTALLATION IN THIS COUNTRY

The accompanying picture is from a night photograph of the first installation of Cooper-Hewitt, quartz-tube, mercury-arc lamps for street lighting in America. The scene of the picture is Randolph

QUARTZ LAMP INSTALLATION IN CHICAGO—THE FIRST IN THIS COUNTRY

Street, Chicago, between Fifth Avenue and La Salle Street.

The lamps are arranged to illuminate a block length, or 320 feet of street. The street width is 80 feet from building line to building line, and six quartz-tube lamps are staggered, three on one side of the street and three on the other. The lamps are 40 feet above the sidewalk and are suspended eight feet from the building, the height resulting in an entire absence of glare.

The distinctness of the two automobiles standing at the curb shows the excellence of the illumination, for the photograph was taken by the light of the six lamps, four of which appear in the picture. It is easy to read the ordinary newspaper anywhere in the block and all doorways and entrances are well lighted. Although the light is of a greenish color, there are enough yellow and orange rays so that we get away from the marked effect of the ordinary mercury-vapor lamp.

The quartz lamp, while based upon the same fundamental principle as the ordinary mercury vapor lamp, differs from the latter. Both lamps use the vapor of mercury as the luminous body. The mercury-vapor lamp holds the mercury in a long lead glass tube while the quartz lamp has a short tube of pure, fused quartz or silica.

The property of the quartz tube to

withstand a very high temperature makes it possible to have this tube short and the "trimming" consists in renewing a tube which is quite infrequent compared to the attention required by a carbon arc lamp. Each lamp takes 3.5 amperes on 220 volts direct current. Four amperes are required by the 110 volt type. The installation shown operates on 220 volts.

Paris Fire Fighters

Since the Paris fire department reorganized its service of fire engines and other automobile cars, it now ranks among the best equipped in Europe in this respect. While the cars are of the gasoline automobile type, some of them also carry electric motors which aid in operating them. For instance the new hook and ladder turntable automobile is fitted with an electric motor for carrying out part of the movement of the ladder. This automobile represents the latest idea of the kind. On the rear of the truck is a revolving turntable which carries a ladder so that no other support is needed in order to extend the ladder up to 80 feet in the air, to reach the windows of high buildings. A hand movement rotates the platform and also sets the ladder at any given slope, but a 25 horse power electric motor is used to slide out the four sections of the ladder by means of steel cable and pulleys and it can be fully run out within 20 seconds.

What is novel is that the ladder sections slide in again by their own weight, and now the motor is run backwards as a dynamo with the current absorbed by resistance coils, so as to work as an electric brake and ease up the movement of the ladder.

The gasoline motor of the car serves to drive a small dynamo which gives current for the electric motor and also for an arc searchlight.

There is also shown the salvage automobile, of which there are a number in use, and they are mainly used for protecting against water. They carry a great number of heavy tarpaulins, besides all kinds of salvage devices. On the car is also a small dynamo, which gives current for a portable searchlight.

GASOLENE - ELECTRIC FIRE TRUCKS OF PARIS

Static Electricity Fogs Films

On some of the moving picture films obtained by Captain F. E. Kleinschmidt, of the Carnegie Museum expedition to Alaska and Siberia, peculiar and recurring fog marks were observed and for a time challenged explanation. Finally it was discovered that in the intense, dry cold of the Arctic climate static electricity was generated on the rapidly moving film and this, in discharging between metal points caused the fog marks.

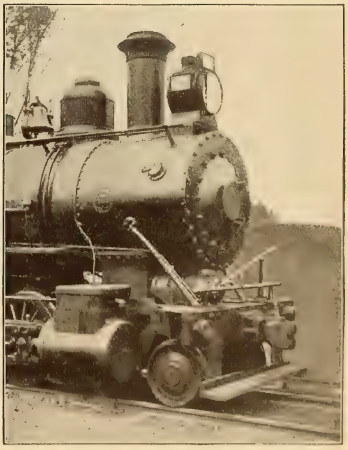
ELECTRIC FURNACE USED BY PROFESSOR MOISSAN IN MAKING DIAMONDS

Prof. Moissan's Furnace

The accompanying view shows the Moissan electric furnace which is in use in the laboratories of the Paris University, and owing to the extremely high heat which it affords, metals and other substances can be melted with ease and even the most refractory ones. Some of the metals or compounds are even given off as vapor and can be thus put through experiments of different kinds. A furnace of this kind was used some years ago in the remarkable work done by the late Prof. Moissan in the production of diamonds, and he actually succeeded in making miniature diamonds in this way. As the method is very difficult and requires great skill, it has not been taken up of late, but the furnace is used for other work.

Lighting the Track Ahead

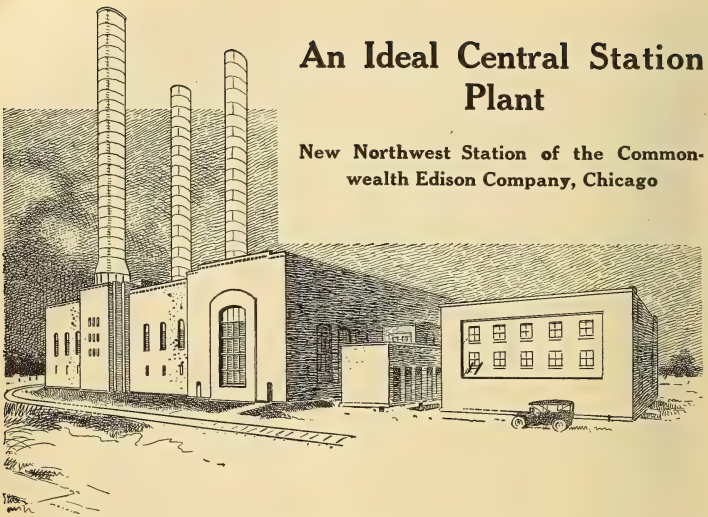
If you were to get up close to the locomotive whose headlight throws a beam of light such a surprisingly long distance down the track at night, you would likely see an equipment similar to that shown in the illustration. The headlight itself is a powerful arc lamp with a suitable reflector. Nestled down upon the front of the locomotive and indicated by the arrow is a small steam turbine direct connected to a direct current generator. The whole outfit is enclosed in a substantial iron casing. The set, rated at one kilowatt, is ample to supply current to the headlight and takes high pressure steam direct from the boiler of the locomotive.



THE ARROW SHOWS THE LOCATION OF THE LIGHTING GENERATOR ON THE LOCOMOTIVE

An Ideal Central Station Plant

New Northwest Station of the Commonwealth Edison Company, Chicago

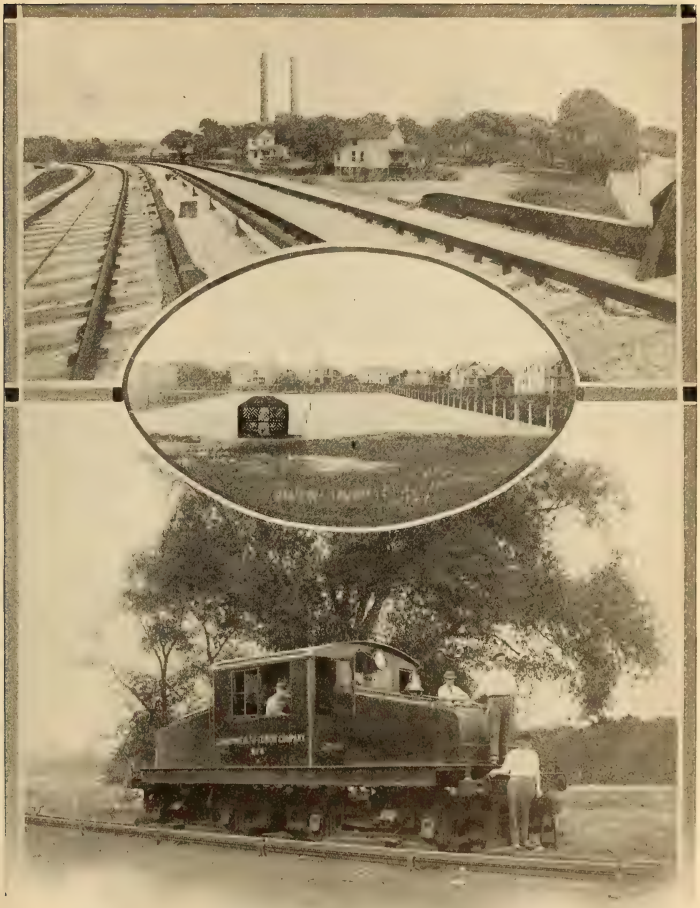


Take the Elston Avenue car from the "Loop" district of Chicago and go away out into the Nor' Nor' west part of the city, across the northern branch of the Chicago River—that branch which is now another part of the drainage channel —and you will come in due time to the entrance gates of what promises to be the greatest and certainly one of the best laid out electric generating plants in the country. It is at present, it is true, only in an initial or embryonic stage but the lines mapped out for future development are good.

Verbena, gladioli, roses, nasturtiums, asters and shrubs and young growing trees of all kinds, not forgetting smooth and well laid lawns are not usually associated with manufacturing plants so far as Chicago is concerned. But it is quite different with this huge new generating station of the Commonwealth Edison Company, called the Northwest Station. The utilitarian while just as marked and projected on even stronger lines of efficiency is softened so far as externals are concerned by tasteful and well planned environment.

Suppose one takes the most westerly entrance to the property which comprises 109 acres, the way will be along pleasant gravel paths bordered with well set out flower beds, in late summer and early autumn gay with all the brilliant favorites of that season. Looking due west it will be seen that the grounds are cut by the high embankment of the company's own electric third rail line connecting with the Chicago and Northwestern Railway at this point. This little internal electric railway is quite scenic, in that it wanders in and around the grounds with the river to the east, while to the north is considerable well treed meadow land. There are also very prosaic and large coal storage yards. The third rail system in use is of the under-contact type so that all interference from ice or snow is avoided and the rail is boxed as to the top with a wooden covering.

The locomotives used are of the same type as those used on the New York

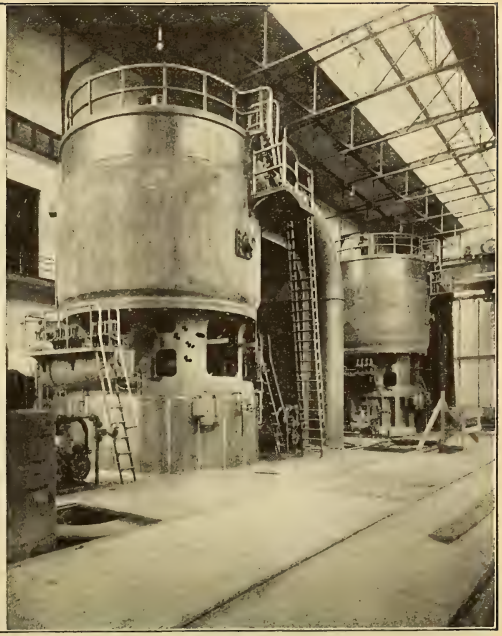


The Great Stacks of the Northwest Station Loom Up in the Distance Over Gardens, Lawns and Shrubbery, All on the Company's Property—a Tasteful and Well Planned Environment. In the Foreground Is a Portion of the Private Third Rail Track System.

Tennis Courts for Northwest Station Employees. Surrounding These Are Employees' Cottages

One of the Third Rail Locomotives Which Does the Coal Hauling on 4½ Miles of Private Track

Boiler Room in Northwest Station Showing Overhead Coal Bunkers With Coal Chutes Leading Down to the Automatic Stokers



Two Immense Steam Turbo-Generator Units of 26,000 Horsepower Now Installed in the Northwest Station.

Central railroad. Each is of 60 tons weight and can haul eight cars of 71 tons.

In all there are 4½ miles of track consisting of switch sidings for hauling the company's coal from the main line of the Chicago and Northwestern Railway Company, and these electric locomotives do the work.

On the west side of the embankment mentioned are the beginnings of various buildings and the excellent gravel tennis courts used by the company's employees, where during the season regular tournaments are held, much enjoyed by the Commonwealth Edison Company players. It may be noted that at various of the company's stations and substations the surrounding lawns have been laid out for courts.

Keeping to the east side of the embankment and along the pleasant walks just mentioned, the first building one meets with is the cottage devoted to a restaurant for private use of the heads of departments at the works. Then as one approaches the plant proper there is another cottage used by the staff of the resident engineer. These offices are well fitted up and equipped, including, of course, telephone communication over the company's private wire with the executive offices in West Adams Street. Meals are served in the restaurant at a cost of 25 cents to employees.

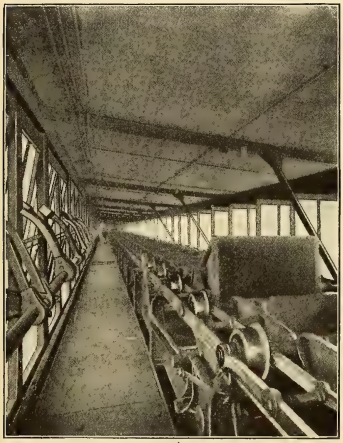
As may be readily expected the approaches to the main building from the western side are more or less through a network of third rail tracks marked "Dangerous" over which one passes only at regular crossings where the connection ceases. The main building itself, in so far as it is completed, is a huge structure of steel covered with vitrified paving brick lined with white glazed brick and having a tessellated pavement. It contains at this time in operation two units of 26,000 horsepower each, classed among the largest turbo-generators ever built and of the very latest design and construction.

There is also floor room in this building for two additional units of the same capacity. Overhead, running from end to end, is a splendid 110 ton Morgan crane used for putting the machinery in place and moving any piece necessary. A broad iron staircase takes one up into a gallery from which one passes into the boiler room. Here we see the automatic stoker at its best. Rather different in design from those in service at the Fisk and Quarry Street plants—the hoppers run down with huge tubes automatically feeding the fires and being themselves fed from the coal cars below, which are run directly in on the third rail tracks and from which the coal is lifted by big electrically operated shovels or buckets —just as you see the steam shovel at work excavating for track laying on any railway, only this is all done by electricity.

To give this process of handling coal, which is most interesting, a little more in detail, there are in the boiler house basement, running centrally beneath each two rows of boilers, four railway tracks. The two outer tracks are directly below the ash bunkers, the inner tracks being for loaded coal cars. A traveling coal handling crane with grab-bucket spans these two tracks, but hopper bottom cars discharge directly into coal receiving hoppers beneath the rails, holding 74 tons for each boiler. Below these hoppers runs another space with a track on which is a large traveling coal crusher spanning a 34 by 36 inch bucket conveyor. The latter encircles vertically the entire double boiler section, discharging into overhead coal bunkers. The latter hold 63 tons for each boiler. The station bunkers thus have a capacity of nearly 1,400 tons for each unit of ten boilers. The heating surface of each boiler is 5,600 square feet. The steam pressure is approximately 250 pounds. The steel stacks—one to each set of ten boilers—which may be seen for miles away rise 250 feet above the boiler room floor, which in turn is 21 feet higher than the floor of the

turbine room. In the basement of the boiler room there is also installed the machinery for the oiling system.

The space in the grounds allowed for coal storage is sufficient for 250,000 tons when all the plans are completed. At present there is always on hand 10,000



One of the Coal Conveyors of the Northwest Station

tons, with a capacity for 20,000, for the two units now in operation.

The vast amount of ashes derived from the great consumption of coal is either sold for a mere song, or to a certain extent given to the railway company for hauling it away.

A word as to the condensing water for the station. It enters a crib intake at the river's edge, flowing through a concrete tunnel of 90 square feet rectangular cross section into the station and out again at a different point. The circulation equals 210,000 gallons per hour per unit.

The other two buildings so far erected are the transformer and switch houses. From out these run at present sixteen transmission lines, serving a territory of about 40 square miles.

It is the ultimate purpose to have a twin station with a total capacity of approximately 320,000 horsepower, but that will not be for several years to come. The first station when completed will have a capacity of approximately 160,000 horsepower.

All around for miles a practically new and most thriving part of Chicago is springing up. Go due north and you find yourself in a very large and new residence district, the creation of the last five years and growing month by month at an enormous rate, while south and west and east there is a steady growth in manufacturing enterprises.

It is readily understood then, that the electrical needs of Chicago's ever growing population will be come vaster and vaster as years go by and when electrification of terminals and practically universal use of electricity has come to pass, even the supply generated by this huge station, when completed, will have become a matter of comparative insignificance.

Ground for this station was broken in October 1910. The two units described were put into active operation in August of this year. There are now 70 employees and every care has been taken to provide ample convenience for the physical comfort and general welfare of the operating force. When the right of way was acquired a good many dwellings were acquired with it—cottages which have since been improved and repaired and leased to employees.

And as one turns away from this breezy new part of Chicago, all a matter of the last few years, and looking back sees a gardener at work raking his flower beds and planting his grass seed for lawns right up to the walls of the main building one realizes that this is a new age indeed, and that big, fine, well equipped, business institutions must have big, fine surroundings, conveniences and comforts for the humblest as well as the highest of the workers within their gates.

Mill Mountain Incline

Roanoke, Virginia, is built at the foot of an imposing hill 900 feet higher than the city, and with 25 acres of beautiful forest on its summit. On account of its inaccesibility, as the average grade is 50 per cent, the city derived no pleasure from this unusual advantage, until about two years ago, when $40,000 was raised among the public spirited business men and Mill Mountain Incline,

MILL MOUNTAIN INCLINE

Incorporated, was organized to build the incline and convert the mountain into a park. The plans were immediately executed and the park has been enjoyed by the public two seasons.

The incline, which is 2200 feet long, has a double track with a car running each way. These cars are connected by two cables, one carrying the weight of the car and the other slightly slack for emergency. These cables pass around drums at the top of the incline. The drums are operated by electric motors. When one car is ascending the other is descending, so if the cars are about equally loaded the weight of the one descending will raise the other, thus only requiring the electric power for the start.

The operating cost of the incline is about $500 a month, but as during the season an average of 600 people a month visit the top, each paying 25 cents for the round trip, the investment is not only an example of civic pride and progressiveness, but a good financial proposition.

Loud Speaking Telephone for the Home

An interesting adaptation of the loud speaking telephone for household use is made by a French manufacturer. The transmitter and receiver are contained in a little box which may be placed on a table or stand, and which is surmounted by a vase for flowers or some little comic head or other attractive, ornamental de-

VARIOUS FORMS ADAPTED TO THE TRANSMITTER AND RECEIVER OF A HOUSEHOLD LOUD SPEAKING TELEPHONE

sign. By pressing a button on the side of the case the mistress can signal servants in any other room in the house where a similar instrument is located. Then she gives her orders in an ordinary tone of voice. She can also overhear anything that is said in the distant room.

Shooting at Moving Pictures

The very newest idea for shooting galleries is to have the marksman shoot at moving pictures, both to test his accuracy in firing at moving objects and his judgment of distance, both of which are brought out almost as well as by shooting in the open. James Paterson of London, England, is the inventor of the device.

Figure 1 shows the marksman at the shooting stand in the act of firing at the motion picture on the screen before him. At the left is the lantern which projects the picture. In the picture on the screen a scout is in the act of firing at the observer. This scout may advance, retreat into the distance, run sidewise, hide behind trees, etc., according to the nature of the moving picture film, and he forms just as hard an object to hit as if he were a man actually running out there in the woods.

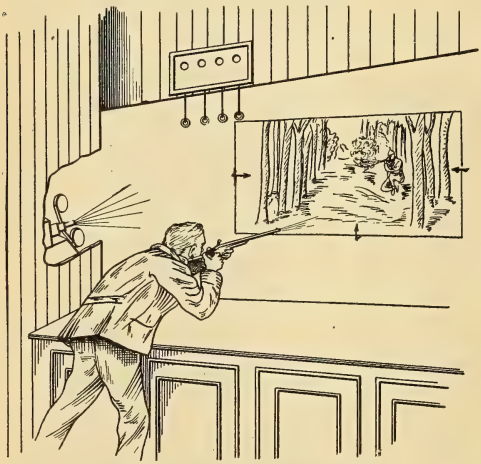


FIG. 1. SHOOTING AT MOVING PICTURES

The screen upon which the picture is thrown is made of paper or cloth so as to form no obstacle for the bullet. Right behind the screen is the real target, although the marksman does not see it. This target is about the size of the scout in the picture and it is made up, as shown in Fig. 2, of a number of movable concave members having plungers in the rear which make electrical contact and work an annunciator up at the stand when a hit is made—indicating in this way what part of the scout or moving creature has been hit.

Finally an arrangement is provided to move this target indicator around in the rear of the screen so as to follow the moving figure about wherever it may go. This is done by mounting the target on suitable wires or cords, giving it a lateral, vertical and rearward movement at the will of the operator who controls it from out in front. To enable the operator to follow the movements of the, to him, invisible target the three arrows near the margins of the picture are so connected to the system of cords as to indicate to him the position of the target—all he has to do is to watch the arrows and keep them all pointing at the moving object on the screen.

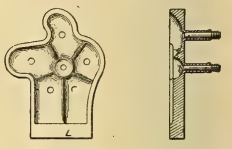


FIG. 2. CONTACT MAKER FOR THE TARGET

Electric energy with which to operate machinery in nearly all the mines surrounding Johannesburg, South Africa, will be generated by a station that, the specifications indicate, will be probably one of the two largest in the world.

London's "Human Spiders"

Londoners will soon miss the "human spiders," those men who climb about on the telephone wires in the most perilous positions, says the *Daily Mirror*. The government, which operates the telephone lines, is placing all wires underground, and the men are now busy taking them down. The pictures show a "human spider" working his way along the web, and another breaking up the web.

Electric Heating in Sweden

According to the director of the Gottenborg, Sweden, municipal gas and electric power station, the experiments carried on in Gottenborg last winter prove that it is practicable to use electricity for general heating purposes, and formal notice is now being given to the effect that the city is prepared to dispose of a certain amount of electrical energy for this purpose.

Since the current for heating can be supplied only between certain hours in the night, it is necessary to have the heat stored in accumulators of some sort to prolong it into the day. For this purpose the ordinary Swedish tile stoves are used, as well as specially constructed accumulators made of pot stone or similar heat resisting material.

In the 22 experiments arrangements were made for heating 86 rooms, 55 ordinary tile stoves being fitted with the necessary apparatus, averaging 1.42 kilowatts, and nineteen smaller stoves with an average of 1.72 kilowatts each. In the experiments 87,473 kilowatts were consumed. The results were found to be rather different in different apartments, much depending on the arrangement of the different heating devices. In seven of the experiments the cost of the energy consumed amounted to three öre (öre = $0.00268) per kilowatt, while in five instances it was between two and three öre and in ten cases less than two öre per kilowatt.

The director of the municipal plant informs the city council that, as a result of the experiments, he is convinced that heating living apartments by means of electricity is economically feasible at a price of three öre per kilowatt, provided proper arrangements are made for installation and storing. At his suggestion the price to the consumer has been fixed per kilowatt year, with an additional price per kilowatt hour to prevent wasting of the current.

Efficient Plan for Canvassing Election Returns

By CHARLES F. BOWEN, State Editor of The Manchester, N. H., Union

To any daily newspaper of large circulation, election night presents the following problem for solution:

Given a certain number of towns in the state, how can the election returns be canvassed promptly, accurately and thoroughly and with the lowest possible outlay of money in gaining the result desired?

The *Manchester Union* is an unique paper in that it is one of the very few which have an entire state to cover, not only in the way of news gathering but in the way of furnishing news to subscribers. It is therefore a matter of prime importance that the election be canvassed thoroughly and promptly for the morning edition of the day after election.

Now, in New Hampshire there are nearly 290 towns and some of them are set down in the heart of wildernesses. Others have no telephone connection and some, so small that but two votes were cast in September primaries, this year, cannot tell in advance whether there will be an election or not.

A great deal of money could be wasted in covering New Hampshire's towns, for instance by having each correspondent (the *Union* has one in every town), telephone or telegraph into the office at Manchester the results that day or night. This would be prohibitive in cost and would not be feasible because of the failure of some of the less energetic correspondents to get the returns in promptly.

The plan devised by the writer and used with great success is dependent upon telephone toll centers. From an inspection of the telephone map of New Hampshire, shown herewith, it is seen that the entire state is dotted with centers from

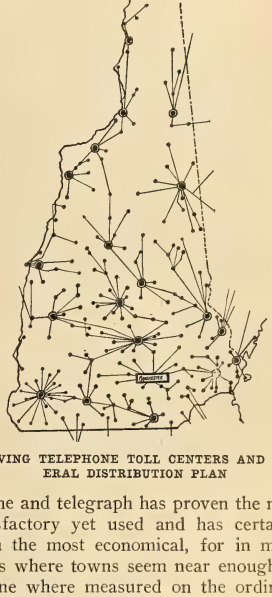
POLITICAL ROOM AT THE NEW HAMPSHIRE "UNION" OFFICE, SEPTEMBER 3, 1912. GATHERING RETURNS FROM THE BIENNIAL PRIMARY ELECTIONS

which radiate in all directions local telephone lines to smaller towns or smaller toll centers. As a general thing the correspondents at these centers are better than at smaller places because the places are usually bigger, busier and more newsy. As far as is possible, then, the returns are handled from toll centers, the reporter at those places being assigned all the towns for which his is the center. It is thus possible to get the number of reporters at work on the returns down to 55 and still get all of the 290 towns.

The reporters collect from the places assigned them and then file the entire collection via telegraph or telephone. A great many dollars in toll bills are thus saved. It is also more convenient for the office to handle the returns in this way, for it is possible to so instruct the 55 reporters in the manner of making up the dispatches that the copy will require but little editing at the office, whereas 290 messages would likely enough be all different and give a great deal of trouble in arrangement.

The accompanying picture, taken especially for POPULAR ELECTRICITY MAGAZINE, shows the political room at a dull primary election, Sept. 3d. At the general election of November four times as many men will be engaged. In tabulating the vote, the data from the reporters goes first to the "governor man," so called, who takes off the vote cast for governor and checks it. It then goes to the assistant who handles the councilor vote in the several districts, next to the "senator man," and so on down to register of deeds and register of probate. Most of the telephoning is done in other parts of the building where the calling of numbers and repeating of votes will not disturb the computers. When a vote is nearly complete adding machines are set to work to determine the totals. To supplement these printed blanks with stamped-addressed envelopes are sent to every town clerk with request to mail them to the *Union* promptly when he determines the vote cast.

In making up the assignments of towns, access was had to a regular telephone tariff book, such as every chief operator has. This book gives the toll center for every town and city and affords a ready means of dividing up the state. This system of working by tele-



SHOWING TELEPHONE TOLL CENTERS AND GENERAL DISTRIBUTION PLAN

phone and telegraph has proven the most satisfactory yet used and has certainly been the most economical, for in many cases where towns seem near enough by airline where measured on the ordinary map, it is found that they are connected to totally different toll centers and that telephone connection between them is very expensive.

Light for Sultan of Lahej

One of the recent purchases made at Cairo, Egypt, by the Sultan of Lahej is a dynamo for generating light in his palace at Lahej, an Arabian town eighteen miles northwest of Aden. A large number of electric lamps, wires and other fixtures have also been purchased.

Electrical Invention and a Larger Patent Office

By WALDON FAWCETT

There is a strong prospect that after years of waiting and ever increasing need, the inventors of the United States are at last to enjoy the benefits of a new and larger Patent Office. Every man who has at any time in recent years es-

President Taft's Economy and Efficiency Commission Just Appointed to Investigate the U. S. Patent Office. Left to Right—Dr. W. F. Willoughby, Harvey S. Chase, Dr. F. A. Cleveland (Chairman), Prof. Frank H. Goodnow, Judge W. W. Warwick, M. O. Chance

Edward B. Moore, U. S. Commissioner of Patents

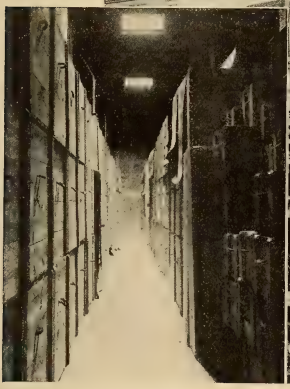
sayed to take out a patent on any child of his brain can appreciate how the interests of the whole inventive community will be served by improved facilities for the governmental handling of patent applications.

In the expectation of the persons best qualified to judge a new and enlarged United States Patent Office, such as it is now proposed to erect, would be synonymous with a number of separate and distinct blessings for inventors as a class. To mention only a few it may be cited that the facilities of the modernized institution would expedite the examination of applications and the issuance of patents. Adequate record and filing equipment would facilitate the work of inventors and others who desire to consult the archives of the Patent Office

and who are hopelessly handicapped by the present congested conditions. Museum space would be provided for the display of some of the nation's most interesting relics—the original patent models of notable inventions, including a number of early electrical inventions.

jeopardy include not only the original papers in all patent cases, but also all records of deeds of assignment of titles to inventions. The latter are of the greatest value in determining the ownership of valuable inventions. Just imagine, for instance, the confusion that would follow the destruction of the deeds of assignment in the electrical field where so many of the most valuable patents have been transferred. And as though the menace of fire were not sufficient the present Patent Office holds another bugbear through the

A Typical Corner in the U. S. Patent Office



The Unfortunate Fate of Valuable Models of Patents—Stored in a Damp Basement

The "Search Room" Where Inventors Consult Files of the Patent Office—Somewhat Crowded

After all, however, perhaps the most potent argument in favor of a new Patent Office is found in the dangers that beset the secret archives of the office, which if destroyed could never be replaced and the loss of which would work untold damage to the commercial and inventive interests of the country. The present Patent Office structure is not fireproof and every nook and cranny of it is piled high with tons upon tons of inflammable matter comprising these valuable papers. The documents thus in present necessity of storing some records in the basement of the overcrowded building. Indeed, only recently many tons of valuable papers were removed from the basement in a rotted condition, owing to the dampness.

Thomas A. Edison and other workers for the broad cause of invention have pushed energetically during the past few years the agitation for a new Patent Office and an improvement of the entire patent system. The delay in providing a new building has been particularly inex-

plainable to many persons because the Patent Office is one of the few institutions of our government that is self supporting. More than that, the surplus of receipts over expenditures now amounts to more than $7,000,000 and it is argued that some if not all of this sum should be used to furnish larger and better quarters with modern facilities for the force, which would then be in a position to accomplish the best possible results in the work for which the inventive public pays the total cost.

But, as has been said, the dreams of a millennium in the patent situation appear to be on the eve of realization. Such has been the pressure of public sentiment that both of the leading political parties have declared in favor of a revision of the patent laws at the next session of Congress with a view to improving conditions in general, and with the specific object of so increasing the rigidity of Patent Office examinations as virtually to prevent the issuance of patents except for real inventions. By thus strengthening the validity of patents, a United States patent will become a more valuable asset for the inventor. He will not be confronted, as at present, with a prospect of prolonged and costly litigation to determine his patent rights, and this dependability of the government guaranty on an invention is expected to do much to stimulate invention and industry.

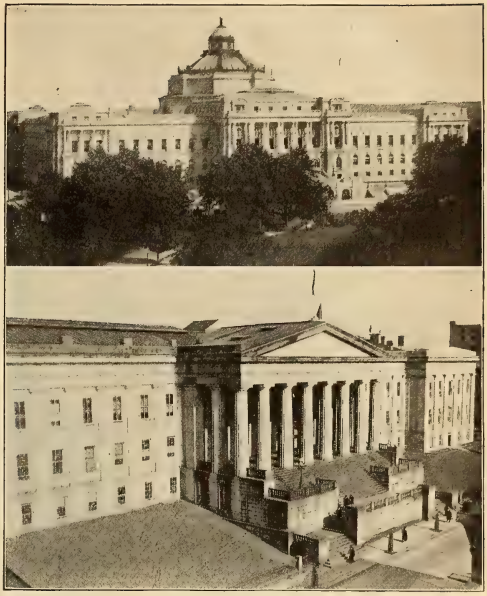
At the last session of Congress the sum of $10,000 was appropriated to enable the President's Commission on Economy and Efficiency to thoroughly investigate the United States Patent Office as to methods, personnel, equipment and building, and it is expected that the findings and recommendations of this board of business experts will serve as a guide in the rehabilitation that is now in prospect. The most promising proposal for a new Patent Office contemplates the erection of a monumental building on Capitol Hill, facing the United States Capitol. The new Patent Office would, in that event, be architecturally a companion structure to the beautiful Library of Congress and would be erected on an adjoining site. Such an arrangement would be eminently fitting as it would bring into close relation the two governmental institutions which were fostered by the same clause of the Constitution and which are kindred in purpose. Furthermore, the proximity of the structures would greatly facilitate the researches of inventors and others who may desire to consult books and records in the Congressional Library as well as in the scientific and technical library of the Patent Office.

The provision of a new Patent Office and the adoption of an improved administrative and examining system would hold greater significance for no class of inventors and producers more than for the devotees of electricity. The explanation is found in the fact that applications for electrical patents are especially numerous and, as a rule, require particularly thorough and detailed examination. Furthermore, the present quarters of the electrical examining divisions of the Patent Office—located on the ground floor and poorly lighted—offer exceptional opportunities for improvement. And finally, this overhauling of the patent system comes at a most opportune time for electrical interests, for such has been the recent increase of inventive activity in the electrical arts that the need for added facilities for the examination of patent applications in this field is well nigh imperative.

The importance of electrical science in the operations of the Patent Office is eloquently attested by the fact that there are four divisions of the institution devoted to the examination of electrical inventions, whereas no other industry in the whole range of human activities is represented by more than a single division in the Patent Office. This apportionment of responsibility, or specialization, in the examination of electrical inventions has been a development of the past quarter of a century. Prior to that time all electrical inventions of whatever character were passed upon in one divi-

sion. This original division, known as Electrical Division A, continues in existence but its scope is now restricted to telegraphy and telephony.

In the year 1886 Electrical Division B was created and has jurisdiction over the subjects of generation and motive power. Then in 1902 there was further subdivision of the interests of inventors working with the magic current by the creation of Electrical Division C, which concerns itself with conductors, electric lighting and general applications. The fourth division in the group is that of Electric Railways and Signaling and, as may be surmised from the name, is a highly important one. Even this elaboration of Uncle Sam's machinery for passing judgment upon electrical patents would not suffice to keep pace with electrical progress had not the Patent Office in recent years adopted the policy of not burdening the examiners in the electrical divisions with inventions in which only a minor or supplementary use is made of electric power. One of the veteran electrical experts tells, for instance, of an experience of the early days when he, wholly ignorant as to the process of manufacture involved, was called upon to examine a huge machine for manufacturing horse shoe nails simply because one minor operation in connection with the feeding of the raw material was performed by electricity. There is no such "lost motion" in the Patent Office in this day and age. A newly invented machine, destined to be operated by electric motor, does not require any attention from the electrical examiners unless the motor represents an innovation in some form.



At the Bottom Is the Present Patent Office Building and Above Is the Congressional Library, Which May Be Taken as a Pattern in Constructing the New Patent Office

But for all that the Federal experts are thus concentrating their attention upon distinctly new achievement in the electrical field, the activity in the electrical inventive field in recent years has been such that the facilities of all the electrical examining divisions are sorely taxed, and in no section of the Patent Office is the need of larger quarters and better equipment felt more keenly. It seems as though a trend of development had been delegated to congest each of the several divisions. The marvelous evolution of wireless telegraphy and

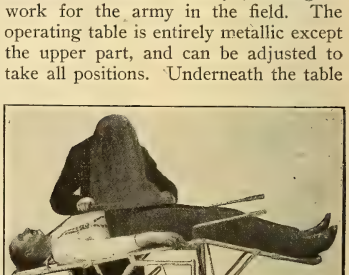
wireless telephony has provided Division A with heavy new responsibilities. In the case of Division B there is the same story to tell owing to the new theories and practice with reference to motors and transmission, the increase in polyphase work, the introduction of electric starting devices for automobiles, and the present activity of invention in the field of electric elevators, the aim and object in this latter field being to attain greater safety and greater speed. In Division C the appearance of mercury vapor lighting, the tungsten lamp, etc., may be cited as indicative of multiplied duties for the examiners and every reader will realize instinctively that much study and research has been required to enable men to sit as arbiters in that complex inventive field which embraces electric railways and signaling—a sphere in which the past decade has witnessed the appearance of many new factors, revolutionary in influence.

Generally speaking, the examination of electrical inventions at the Patent Office involves more tedious and painstaking work than is required in almost any other branch. In many mechanical fields it is possible to pass upon inventions by merely consulting the drawings submitted, but in the case of most electrical inventions it is necessary to also refer in detail to the specifications furnished. The electrical examiners are also called upon to consider an undue proportion of what are known as "paper inventions," that is electrical inventions which have never been tried out in practice and which in a large number of instances are not patentable. Visionaries with schemes of the "perpetual motion" class are also more or less heavy contributors to the grist of applications for electrical patents.

An interesting side light upon electrical invention is found in the increasing proportion of the whole number of electrical patents granted which now go to inventors employed on a salary or other basis by the large electrical corporations. Such firms are no longer open to the suspicion that they seek to steal the ideas of a resourceful employee. On the contrary they encourage employees in all branches of the industry to submit inventive ideas, rewarding them liberally when the proposed inventions prove serviceable.

Novel X-Ray Apparatus

A new X-ray apparatus, which the engraving represents, has been brought out in Paris in order to carry out surgical work for the army in the field. The operating table is entirely metallic except the upper part, and can be adjusted to take all positions. Underneath the table



X-RAY APPARATUS WHICH CAN BE USED IN A FULL LIGHTED ROOM

is a cross bar carrying an X-ray bulb which can be slid along and adjusted, and this allows the surgeon to inspect by using the rays at the same time that he is operating, so that he works more surely and quickly. It is now an easy matter to find the exact position of bullets in the body by means of the new Ducretet and Roger apparatus, and one of the new points is the use of a dark box with cloth which covers the operator's head so that he can see the X-ray shadow on the screen while in a full lighted room, and darkness is no longer needed. This gives the advantage of allowing other work to go on at the same time.

Quartz Working

Since it takes an exceedingly high temperature to melt quartz, so as to make it up into tubes or vessels, it is only within the last few years that the proper methods have been found for doing this. On the Continent, practically all of the quartz vessels come from Germany, and they are a great aid where substances need to be heated to a high point where glass would melt.

FINISHING QUARTZ TUBES AND SOME OF THE PRODUCTS

M. Billon Daguerre is now using an electric furnace of his designing by which he hopes to start the new industry in France, and he is now turning out tubes and many shapes of vessels.

Pieces of the transparent rock crystal are put into a crucible and then this is exposed to the powerful heat of the electric arc so that at a certain heat the quartz begins to soften. Then the operator takes out a piece and continues the heating by the oxy-hydrogen blowpipe so as to make up the quartz into a thin rod. By winding this around in spiral and then melting together, he can fashion a tube or a vessel of any usual shape and even some complicated ones, but this process requires a special skill on the part of the workman.

The quartz is not entirely melted in the electric furnace, but is only softened, as this method is found to be the best.

Quartz thermometers are the latest achievement, and they can be used to register high heats where glass would melt. Tubes for mercury vapor lamps are also made in this way.

Street Car Efficiency in Germany

Vice Consul General Roger C. Tredwell, of Dresden, states that the city authorities who control the street car service of Dresden have put in force a system which greatly increases the efficiency of their lines. By their plan it is possible for a stranger to make immediate use of the street railways without either speaking a foreign language or having any of the advance knowledge that is needed in getting about by street car in many cities of Europe and America.

Each of the eighteen car lines is known by number instead of by name, as this makes possible the system of public indexing which is in vogue here. Cars belonging to lines of even numbers are painted red, odd numbers yellow. The number is placed conspicuously on each car, together with the general route, which is indicated by side signs.

Every car carries a conveniently placed piece of glossed cardboard, on one side of which is a route map of all the car lines, together with their numbers, and on the reverse a map showing the various numbered zones into which the city is divided.

The terminals of each line are indicated by signs inside the cars, by which passengers may tell the direction in which they are traveling. As a means of advertisement each car is furnished with a clock and a daily newspaper.

In order to expedite the service cars stop only at specified places, all of which

are marked by red signs attached to lamp posts. These often occur in the middle of a block where the stopping of a car will interfere least with the traffic. The lamp globes show bands of red which make them easily seen at night; and the zones in which they are found are indicated on the posts by bands of white paint, one for each zone. These assist passengers in estimating the correct fare, which is charged according to the zone system. Small white signs project over these bands, showing the numbers of the car lines passing there and the names and directions of the terminals of each line. At the principal railway stations and at other important centers illuminated index signs have been placed for the convenience of strangers. Every street corner is conspicuously labeled in blue with the name of the street and the numbers of the houses included in each block.

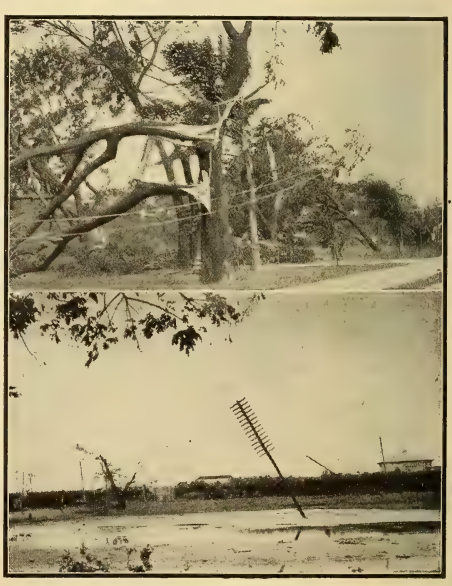
WHY CONDUITS ARE NECESSARY IN THE PHILIPPINES

The cable, telegraph, and telephone companies of the Philippines, especially in the city of Manila, have found the use of underground conduits especially desirable, not so much because of looks and as a means of avoiding accidents, but for a maximum of safety to transmission lines.

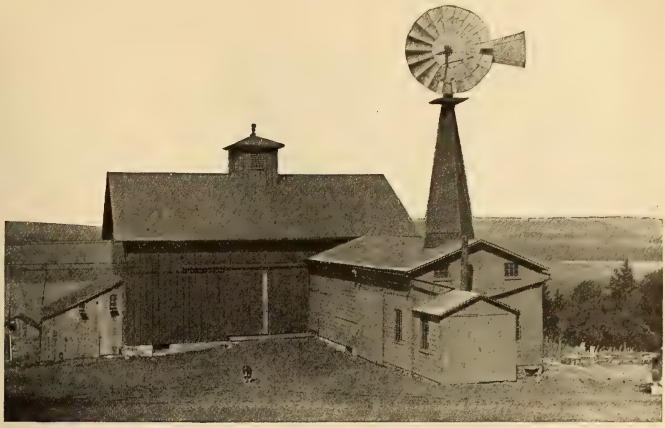
The typhoon reigns as storm king in the Philippines, and some storm king he is, too. Our cyclones and tornadoes are back numbers compared to a typhoon, and the electric pole line that can successfully withstand the onslaught of a full grown typhoon has yet to be built. American electrical engineers after having their systems completely disabled by typhoons soon realized that conduits were the only solution of the problem.

If the wind itself does not succeed in blowing down pole lines, falling trees and the homes of the peasantry, sailing through the air on the installment plan, never fail to carry the lines to the ground, snapping wires and poles.

The transmission lines of the trolley system are reenforced to withstand the force of the typhoons, but in some of the worst storms occurring since American occupation the street car system has more than once been paralyzed, fortunately, though, not for lengthy intervals, owing to the efficiency of the company's management.

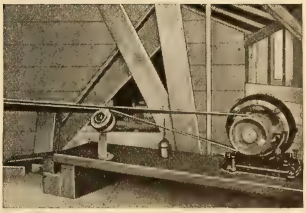


THE RESULTS OF A TYPHOON



LIGHTING PLANT ON THE FARM OF J. F. FORREST, POYNETTE, WISCONSIN

FARM STORAGE BATTERY



FARM DYNAMO

WINDMILL FARM LIGHTING PLANT

The question as to whether or not a windmill is a satisfactory source of power for operating a farm electric plant is difficult to answer. Windmill manufacturers say it is not, and they have done a lot of experimenting along that line. The wind is too erratic, they say, and the difficulties to be overcome in designing the right control devices and in building a satisfactory storage battery to stand up under the arduous duty it has to perform have so far prevented a standardized equipment of this type from being put on the market.

On the other hand, instances have been cited where a plant of this kind has been put into successful operation, using the standard type of storage battery with a cut-in arrangement permitting it to be charged by a windmill driven dynamo. One such is the plant of J. F. Forrest, of Poynette, Wis., which is briefly described in a paper by Mr. Putnam A. Bates, consulting engineer of New York, and pre-

sented at the annual convention of the American Institute of Electrical Engineers, held in Boston last June. We quote from this paper as follows:

"In this instance, a small dynamo (six amperes, 35 volts at 450 revolutions per minute) is belted to the vertical shaft of a windmill. As the mill speed is not constant, an automatic cut-in is introduced in the electric circuit between the dynamo and the storage battery, from which the lighting current is taken, the charging of this battery being the sole duty of the dynamo.

"This plant develops current for 24 fifteen watt 25 volt tungsten lamps. Its whole cost was $250, exclusive of transportation, but including windmill, dynamo, storage battery, automatic cut-in, wire, porcelain insulators, sockets, switches and tungsten lamps. The owner did the complete wiring and arranging of the lights and switches. The two years of successful operation and the cleverness of the lighting scheme, which embodies several two-way and three-way switches for distant control of both exterior and interior lights, is certainly an indication that Mr. Forrest, who runs a farm of some hundred or more acres, has done for himself what many other farmers may also do by a little planning and some interesting labor."

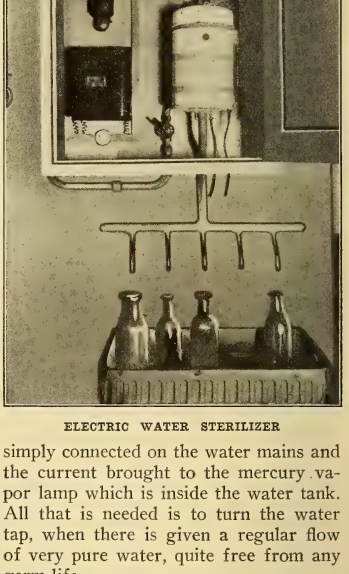
Electric Propulsion for Lake Boat

An order has been placed by the Montreal Transportation Company with John Reid & Company for an electrically propelled vessel for lake traffic. The vessel will be of 2,400 tons and 300 horsepower.

The engine will be of the Diesel type and will drive an alternating current generator whose power will be applied to large induction motors connected to the propeller shaft, which will have a speed of about 80 revolutions per minute. Control will be had by means of switches mounted on the bridge.

French Water Sterilizer

Ever since Prof. V. Henri, of Paris, and others found that the ultra-violet rays from the mercury vapor lamp will kill microbes instantly, it was desired to adopt this very useful method for practical appliances. The water sterilizer made by the Société Internationale is of great interest, as any household, public school or the like can use it when electric current is at hand. The apparatus is



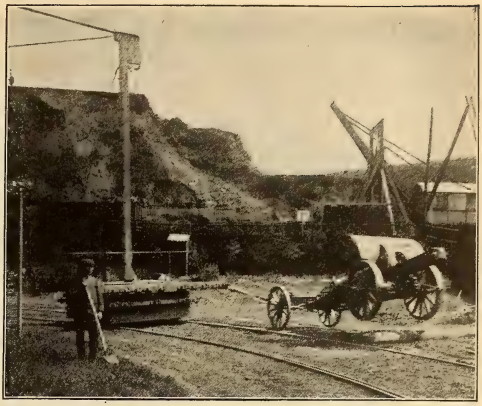
ELECTRIC WATER STERILIZER

simply connected on the water mains and the current brought to the mercury vapor lamp which is inside the water tank. All that is needed is to turn the water tap, when there is given a regular flow of very pure water, quite free from any germ life.

Authorities on questions of health advise the public to wash with water of this kind all food, such as salads, fruits and the like, which are to be consumed raw, as it is well known that many epidemics arise and spread through lack of such precautions. The apparatus avoids the use of boiled water with its flat taste.

Testing Gun Carriages at the Krupp Works

At the great artillery works of the Krupp Company at Essen, Germany, a circular electric track is laid out in order to give a test upon field cannon or ammunition wagons. Upon the track runs an electric car, and the cannon are attached to it so as to be drawn around the track and put through many kinds of endurance tests. A circular ring for drawing the cannon lies on the outside of the electric track, and it is paved in some parts and in others represents country roads of different kinds, such as are met with in real practice. The electric car is much better than horses, as it can make high speeds so as to put the cannon through a severe strain.



A STRENUOUS TEST FOR GUN CARRIAGES

Electricity Creator and Destroyer

The human body is a good conductor of electricity in the same way that the air is a poor conductor. But the body is composed of such a number of substances that it is evident some of its parts must be good conductors and others bad. Those which are good in such a case convey the current easily, those that are not so good either convey the current with resistance or refuse to convey it at all. These two factors respectively are considered in the use of electricity for purposes of medicine and electricity for purposes of execution. The electric current that the doctor gives in his private office for the soothing of pain is the same electricity that is given in the death chamber of Sing Sing, only there is more of it in the latter case.

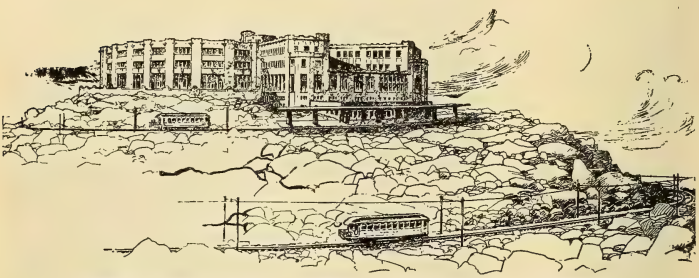
Among the substances in the human body which are good conductors of electricity is salt, chloride of sodium. This compound is what is called an electrolyte —that is, it really breaks up into its simple parts when the electric current is passed through, and under certain conditions of the body this is of value. For some conditions of malignant growths the use of the direct current is of help in assisting a cure, the acids and alkalies set free by the current helping the molecules of the tissue of the body to build themselves up again.

When, however, the current is so strong that the substances in the body which are good conductors of electricity are not enough to carry the current, it stands to reason that the force makes its way at any cost, so thoroughly disrupting the resisting tissues that death ensues. It is the realization of this which makes electricity in medicine something to be used with the utmost caution and only by the hands of the most expert. Modern science is advancing daily in the understanding of the relation of electricity to life, but so far, our knowledge is very incomplete.

DR. L. K. HIRSHBERG.

Circular Railway Up Mount Washington

By LIVINGSTON WRIGHT



CIRCULAR RAILWAY AS IT WILL APPEAR AT THE TOP OF MT. WASHINGTON

The most unique electric railway in the country will be that recently surveyed for Mt. Washington. This novel railway is only part of a huge improvement project for providing this famous mountain with the most up-to-date summer resort appointments. An outlay of over $1,500,000 is to be expended upon the railway, power plant and, at the summit, upon a magnificent new hotel, which is to be erected. It will be the only hostelry in the world that can boast of having a mountain top sticking through its floor!

The new electric road will supplant the celebrated "cog wheel" railway, which ran its first train up the mountain in 1869 and cost $150,000. The new line will be about 20 miles in length and will circle the mountain 2½ times before it reaches the summit.

The present railroad (Boston & Maine) from Fabyans to the base, a distance of seven miles, will be electrified. From here, the new line will have a station at Bretton Woods, where the Mt. Washington and Mount Pleasant hotels are. Then, turning to the left the line passes Lake Carolyn and the Bretton Woods golf links, along the rocky gorge of the Amoonusuc. The southern peaks of the Presidential range are seen at the right—Monroe, Franklin, Pleasant, Clinton, Jackson and Webster. Mt. Washington is supported on the left by Clay and Jefferson. The line climbing higher reaches the base, 1,000 feet above Fabyan and Bretton Woods.

At the base the new electric railway up the mountain begins. It starts at exactly right angles to the present line and at several points runs directly away from the summit of the mountain.

On the west slope of Mt. Jefferson, the new route presented extreme difficulties, making it necessary to put in two switchbacks. In a direct line from Jefferson Notch to the highest point to which the railway runs is a distance of less than a mile and a half, but by the new line it is six miles long. After the road passes over itself, it runs back toward Base Station, but always climbing higher. At the first switchback, there is in front a sheer drop of a thousand feet. It can be realized that as a scenic purveyor, this new electric line is going to give passengers the value of their money. Every ingenuity that could be devised for doubling and twisting and careering in order to enable tourists to "see it all" has surely been taken advantage of.

Coming in sight of the Lakes of the Clouds, the road makes an abrupt turn to

the left, beginning the circling of the summit and giving a wonderful view down into Truckerman's Ravine. Climbing higher, it runs above the Alpine Garden and unfolds views toward North Conway, Lake Winnepesaukee and Portland. Making a turn to the left the road doubles back and crosses the carriage road, looking down into the Great Gulf with Spaulding Lake about 1,200 feet below. Again in crossing the old cog road the electric line completes a circuit of the summit but makes another complete turn and comes to an end in front of the new hotel, having run two and a half times around the top of Mt. Washington.

Unique among hotels will be this hostelry on the highest peak of New England. Every room will be an outside room and there will be 100 of them. In planning it the most unusual features have been incorporated. The architect who planned the new hotel had had years of experience in this particular specialty of mountain resorts, having, among others, incorporated many new features in the Yellowstone Park hotels. Accordingly, one special aim was to secure ample accommodation both for those who would stay at the summit but a few hours and for those who would spend the night. Thus, a dining-room to seat over 400 will be one of the features.

The observatory of the hotel, 150 feet in diameter and with glass sides, will be located on the very highest tip of the mountain and a picturesque feature will be in having the tip of the mountain itself protrude through the floor so that one may stand on the summit and view the horizon for 312 degrees of the circle.

On completion of the new electric line, the venerable "cog wheel" will be abandoned.

The pumping station at the base to supply the summit with water is already completed, as is the pipe line to the summit. This plant is unusual in that the water is pumped in one stage or lift from base to summit, an altitude of 3,700 feet, and the pressure consequently is tremendous.

The power plant which will generate the electricity to keep this vast enterprise of railway, hotel and subsidiary plants in operation will be located on the Amoonusuc river at the base.

Electric cars will start at Fabyans and run through to the summit without change in less than two hours.

An Electric Heater for the Table

The very convenient little electric radiator illustrated is made by a Paris firm, and it may often come into use where only a small amount of heat is needed. The new radiators of this type make use of an electric resistance of a very fine metal wire disposed in the form of a grid, and the wire takes but a small current but

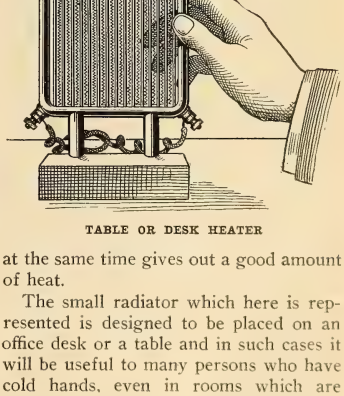


TABLE OR DESK HEATER

at the same time gives out a good amount of heat.

The small radiator which here is represented is designed to be placed on an office desk or a table and in such cases it will be useful to many persons who have cold hands, even in rooms which are otherwise heated. A good warmth is thus secured without obliging them to change their place. Larger sizes of radiators on the same principle are also made.

Sir Joseph Beecham Comments on English Electrical Affairs

Sometime ago we sent letters to our foreign subscribers, who represent almost every civilized country, asking them to write to us in return, telling something of themselves and of the electrical conditions in their locality. Among letters so far received is one from Sir Joseph Beecham of Ewanville, Huyton, near Liverpool, England. Sir Joseph gives some interesting facts concerning the municipality of St. Helens, of which he is mayor—particularly the electrical undertakings—and the following is quoted from his letter.—Editorial Note.

"You ask me to tell you something about myself and my surroundings. My business is the manufacture of an article well known in your city and country. The business is carried on at St. Helens (six miles from here), of which city I am mayor for the third time.

"It will probably be of interest if I give you some particulars as to how the city is governed. It is divided into nine wards, each ward returning three councillors, who are elected by the people for three years, one retiring each year. These elections take place on November 1st. Each ward is also represented by one alderman (someone who has had considerable experience in municipal work) who is elected by the councillors, and usually for a term of six years. This brings the total number of the council up to 36 members. Once a month the whole of the council meet, when the minutes of the various committees are brought up for confirmation and discussion. At this meeting the mayor presides.

"The city owns its own water, gas and electricity, also other undertakings. These and other departments such as health, parks, highways, finance, etc., are each managed by specially appointed committees of the council under the direction of a chairman. I am chairman of the electricity committee. Only the permanent officials are paid, everyone else giving his time and services free, the desire being to obtain good local government.

"A description of our electricity undertaking will, no doubt, interest you more than anything else, so I will give you a brief outline of what has been done.

"Our population is about 97,000. The electricity committee was formed in 1895, and I have been the chairman since November 1899. In 1896 the installation at our lighting and power station consisted of Lancashire boilers and two Ferranti steam alternators supplying single phase energy at 2000 volts. Very shortly afterwards, the council decided to construct tramways, and, when the question of the enlargement of the power station came up for discussion, it was decided to erect an entirely new station on a fresh site, putting in plant for generating continuous current, and scrapping the old plant. St. Helens is a scattered city, and, as the demand for power grew from the more distant manufacturers, it was decided in 1909 to install an extra high tension, three phase alternating plant at 6000 volts, 50 cycles, which is transformed to 230 volts for lighting and to 400 volts for power.

"In April last year a 100 kilowatt Westinghouse turbo-alternator was put down, and this has since been working very satisfactorily. As the business further increased, it was decided to put in a further 2000 kilowatt turbo-alternator, and this was started at the beginning of the present month.

"We have in the station rotary converters of a total capacity of 1000 kilowatts, thus enabling us to use energy from these machines for tramways, lighting, etc.

SIR JOSEPH BEECHAM'S HOME AT EWANVILLE, HUYTON

"Our sales during the past year amounted to 5,000,000 units (kilowatt hours).

"Our charges are 3½d. (seven cents) per unit for lighting, and one penny (two cents) per unit for power, with discounts up to 40 per cent, depending upon the amount of energy taken and the load factor. There is no charge made for loan of meters.

"Our cost of production has been brought down to .54 of a penny (just over one cent) per unit. Next year ending March 31st, now that the new turbo-alternator is running, we hope to bring the cost below one cent.

"I might add that I put in a plant for lighting my house here in 1886. The installation was one of 50 volts, the dynamo being driven by an eight horse-power gas engine, which charged the battery in the daytime. A few years ago I was able to obtain current from an outside source, and I have done so since. This is 100 volts alternating, and, as I have an organ in the house, it is necessary to use a motor-generator for blowing same.

"The price I am charged for current by the firm which supplies my house is eight cents per kilowatt hour for lighting and two cents for power and heating, irrespective of quantity.

"You ask if I am an American. I am not, being a native of this country. At the same time, I know your country very well indeed, having crossed the Atlantic 52 times, and the continent of America four times. I have been several times in Chicago, my first visit being in 1879, when I stayed at what was then one of the principal hotels, namely, the Grand Pacific. I have visited the city a number of times since.

"You will probably wonder how I became acquainted with your magazine. It was at an Electrical Exhibition in Madison Square Garden, New York, in October, 1910, where I subscribed for it. I think it is an excellent magazine, the name is very appropriate and the various articles are written in a manner that appeals to the vast majority of people who wish to be interested in such subjects, but usually find them written in language full of technical terms suitable only to the experienced electrical engineer. I have shown several copies to our elec-

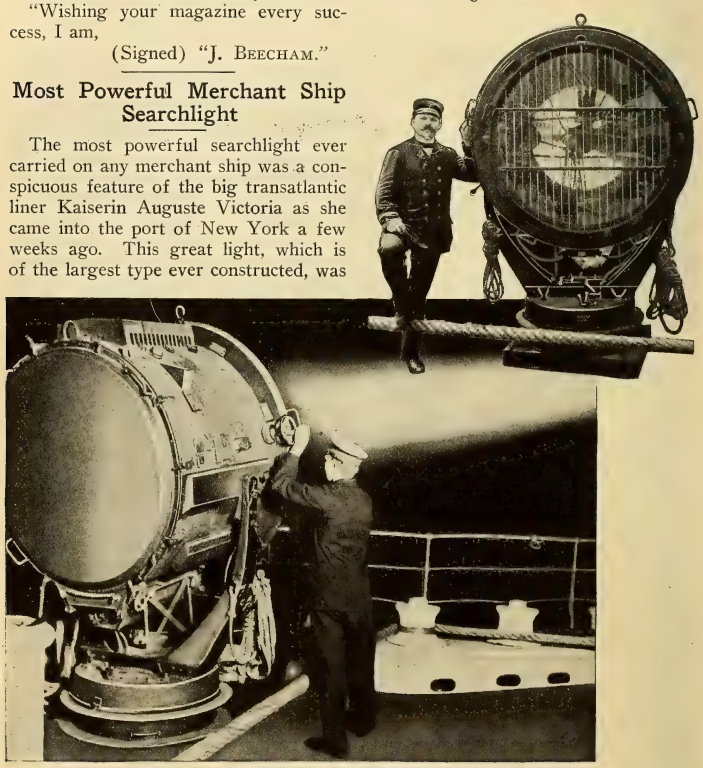
trical engineer, who informs me that he has read them with great interest. There is no doubt that such a magazine is bound to become more increasingly popular as it becomes more widely known.

"Wishing your magazine every success, I am,

(Signed) "J. BEECHAM."

Most Powerful Merchant Ship Searchlight

The most powerful searchlight ever carried on any merchant ship was a conspicuous feature of the big transatlantic liner Kaiserin Auguste Victoria as she came into the port of New York a few weeks ago. This great light, which is of the largest type ever constructed, was visible at a distance of several miles. The great light is effective for seven miles across the open sea and when thrown upon the clouds is clearly visible for a distance of 30 miles.



THE GREAT SEARCHLIGHT OF THE KAISERIN AUGUSTE VICTORIA

carried on that trip thoroughly to test it out on sea and entering harbors, after which the same type of lamp will be installed on all the big ships of the line. It threw a beam of light of 80,000 candlepower. On approaching port the light was turned on the Scotland Lightship, rendering the name of the ship clearly

The searchlight was carried on the bow of the ship on this the trial voyage, but it will later be installed in the lookout, high up on the mainmast where it can be quickly swung to any angle. It is of the type used heretofore only on the largest dreadnaught battleships. The lens is 42 inches in diameter. It is operated on a

110 volt circuit and consumes 13,000 watts or over seventeen horse power of electrical energy. In actual tests at sea the rays pierced fogs and distinguishable distant objects at every point of the horizon.

What Is Electricity?

Some years ago, says Mr. John S. Bleecher, in the *Public Service Journal,* when I was instructing motormen in the art of operating street cars, I thought it would be a good plan to prepare a set of questions as a sort of examination for them to pass before approving their instruction as complete, and at the top of the list I put a test question, believing that the kind of an answer I got to this question would indicate the kind of a man I was dealing with.

The question, which even scientists cannot answer, was "What is electricity?" I received many and different answers, displaying originality and inventive genius. Sometimes a man would be frightened by the first question and fall down on the entire list. Such a man I knew was not the proper material for facing emergencies which arose on the front end of a street car. Other men would become discouraged because they did not know just how to answer the question and some would give very interesting and illuminating answers.

One said that "electricity was a kilowatt, and that a kilowatt was a little green bug." Another, "electricity is hot stuff." There is one answer that I did not get but which I believe is the best answer of all, and that is *"electricity is efficiency."*

A Greenback Laundry

During "Made in Chicago" week in that city a prominent home laundry machine company made its display and salesrooms well worth a visit, by laundering real money.

A Thor electric washing machine and an electrically operated and heated mangler did the work. From the National Bank of the Republic $5,000 in soiled bills varying in denomination from $1 to $20 was obtained. These bills were placed in the washing machine just like so many small articles, and after being washed were wrung out. Each bill was then ironed by the mangler, which left the money dry and clean and fit to be passed again.

REAL MONEY WASHED AND MADE USABLE WITH AN ELECTRIC WASHING MACHINE

Ice Harvesting on the Farm

The views herewith present an ice carrying machine driven by electricity on the farm of Dr. Schuyler S. Wheeler. It is described in a paper read by Mr. Putnam A. Bates, consulting engineer of New York, before the annual convention of the American Institute of Electrical Engineers, held in Boston last June. In his paper Mr. Bates quotes from Mr. Wheeler as follows:

"The outfit was eminently practical and satisfactory in every way, and enabled me to fill my house with about 200 tons of ice, using five men and no teams. Previously it has been the custom to employ four to six teams four to five days in addition to these men."

When the bridge was fully elevated, 2.5 horsepower was required, current for which was supplied from the private generating plant ordinarily used for lighting and small power devices.

Saving Lamp Carbon Stubs

Under every carbon arc lamp for street or park lighting will usually be found short pieces of carbon that the trimmer has thrown away. In Germany these stubs of carbon are used. After being taken from the lamp they are squared off on a motor driven grinding wheel and are then cemented to a new carbon. This repaired carbon is placed in the lamp with the stub end at the arc so that the old carbon is thus entirely used.

ICE HARVESTING MACHINERY OF THE MODERN FARMER

Electricity in the Control of Fireworks Displays

Pyrotechnic art with the aid of electricity has reached such perfection that it is possible to produce immense and prolonged pictures of fire as great stage settings in the light of which actors portray the daily life and struggles of the people of a period.

Of these productions the most familar, the most stupendous and at the same time the one in which extreme care must be exercised in installing the electrical system is the production based upon Bulwer Lytton's great novel, "Last Days of Pompeii."

In Pain's presentation of this spectacle the electrical circuits are sixteen in number. It is mystifying to behold a building burst into flames when no one is near, and though the answer is "electricity" this does not explain the devices concealed behind burning Pompeii.

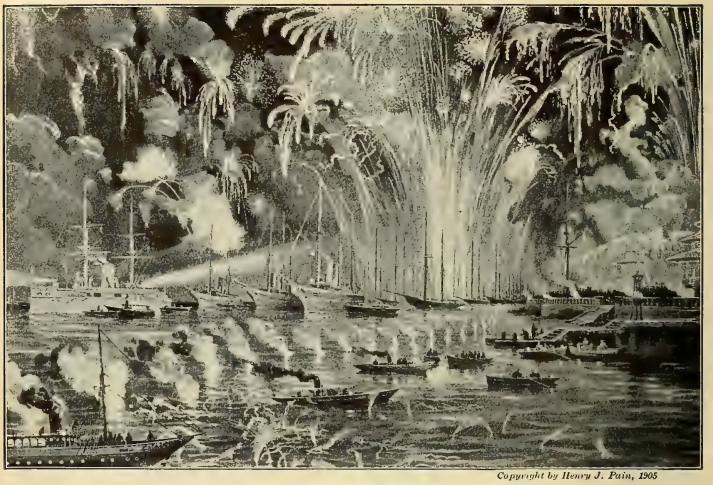
Back behind the Temple of Isis and Mount Vesuvius is a flat keyboard upon which is a circle of brass knobs. At the center of this circle is fastened one end of an arm so that the outer end may be moved at will over any of the knobs. Wires run from different parts of the painted city to this keyboard. One of each pair of wires is connected upon the under side of a knob and the other is connected to the movable arm. Beneath the keyboard is an electric battery.

In witnessing the production you remember the conclusion of the day's festivities, the march to Arbaces' palace, then to the Temple of Isis where the multitude all kneel save one, Glaucus, the Christian. Then follows the command of Arbaces that Glaucus should kneel. Glaucus refuses and the terrible combat before the altar is interrupted by signs of an eruption from Mount Vesuvius. Lightning flashes about the mountain and the crater spits fire.

Just here the operator at the keyboard has moved the arm around to a knob and made contact. Current speeds over the wires and the powder at the crater of the volcano is ignited. Another move of the lever and a long fuse hung upon a framework back of the mountain is set off. Along this fuse at intervals are charges of powder suspended like so many lamps along a wire. The fuse burns to the first charge. There is a flash and those "out in front" see lightning play about the mountain. As the fuse burns on, one after another of the "flashes" explodes, imitating nature's lightning. There are explosions in one place, then in another as the eruption becomes more violent—and the operator plays the arm about the mystic keyboard.

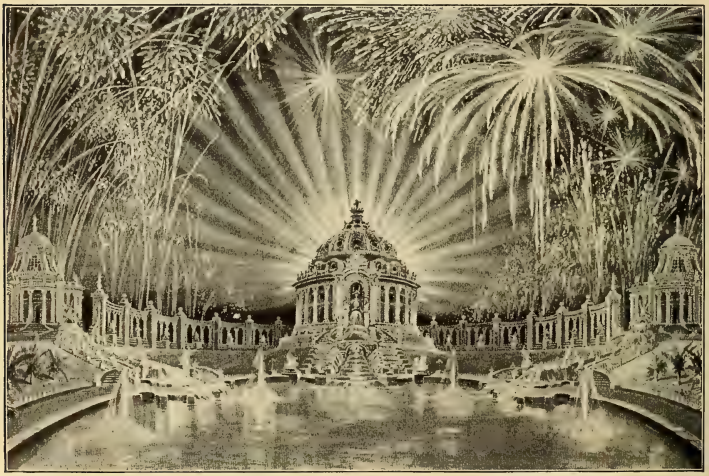
The buildings begin to fall in every direction, and the walls of the city crumble. It is a thrilling and realistic sight when viewed from the front, but back amid the falling buildings and lightning flashes it is wildly exciting.

The tongues of flame, the blinding smoke, the terrific explosions, all originate in very small firing caps or detonators as they are called, in which electricity heats a tiny bit of platinum wire laid in powder. Great care must be given the making of the firing caps or detonators else the current of electricity will not ignite the powder. The cap is a shell about one-fourth of an inch in diameter. It is filled with meal powder, somewhat similar to gunpowder, and a circular piece of tin that fits inside the shell is placed above the powder. There are two holes in the circular tin and an insulated copper wire passes through each into the powder. These wires are connected within by a small platinum wire. The upper half of the cap is filled with melted sulphur which hardens. When the cap is used it is attached to the fuse of the piece it is to ignite and by wires to the keyboard. When the arm presses the proper knob on the keyboard current enters by the copper wire,



Copyright by Henry J. Pain, 1905

THE ROYAL YACHT SQUADRON REGATTA AT COWES



Copyright by Henry J. Pain, 1905

AT THE LOUISIANA PURCHASE EXPOSITION

Copyright by Henry J. Pain, 1905.

JARDINI JERONYMOS, LISBON, 1898. CELEBRATING THE 400TH ANNIVERSARY OF THE DISCOVERY OF INDIA

Copyright by Henry J. Pain, 1905.

DISPLAY AT DUSSELDORF, GERMANY

heats the platinum, sets fire to the meal powder and ignites the fuse.

It is by means of this little contrivance, powder and electricity, that the town of Pompeii is utterly destroyed night after night before wondering audiences and such gorgeous displays as those illustrated made possible.

Dictating Letters by Telephone

In one of the large New York dry goods stores all correspondence is dictated through the telephone.

Ten stenographers are employed in the conduct of the store's correspondence. These stenographers perform their duties in one large room. In this room, a specially designed table has been installed which is provided with five typewriting positions on each side, the typewriting machines being placed about eight inches below the surface of the table. A ten-inch panel extends down the center of the table and on this panel, immediately in front of each stenographer's position, an annunciating drop and a spring jack are installed. Each of the ten typewriting positions is equipped with a breast transmitter and a head receiver terminating in a plug. The spring jack circuits connect to a 40 line standard sub-switchboard which is located at the head of the stenographers' table.

With the equipment now installed, when the services of a stenographer are desired, the party wishing to give dictation merely lifts his receiver and says "Stenographer, please." His extension station to the main house switchboard is immediately connected by a tie line to the sub-switchboard in the stenographers' room. The operator answering the sub-switchboard glances down the stenographers' table, connects to the stenographer who is least occupied, and who immediately plugs into the spring jack with her head receiver and breast transmitter. This equipment permits both hands to be free and the stenographer can either take the dictation in shorthand or write it direct on the machine.—*The Telephone Review.*

STENOGRAPHERS WRITING FROM DICTATION OVER THE TELEPHONE

The Location of Electric Heaters

Turn electric heaters upside down if you wish, or fasten them on the wall, they operate as well in one position as in another. The idea of placing the means for heating rooms, etc., on the floor is one which has become so deep-rooted that when electrical heating devices were first designed for practical use, they were made so that they also occupied floor space. But this space is valuable in some places, as was the experience of a street car company which grew so rapidly that the waiting rooms soon became too small.

The electric heaters in these rooms were spaced about four feet apart on the floor all around the room and projected about eight inches from the wall. This space was saved by placing the heaters about nine feet above the floor on the walls with very good results as to heat.

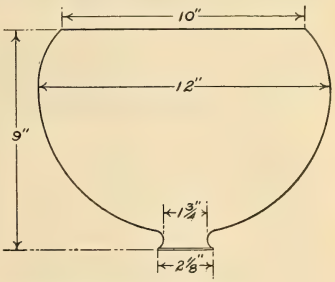
Destroying the Browntail and Gypsy Moths

Although the work has not attracted a great deal of attention outside of New England, it is nevertheless a fact that the United States Department of Agriculture has been expending about $100,000 annually in New Hampshire in an heroic effort to exterminate the dread browntail and gypsy moth pests. In addition, the legislatures of New Hampshire and Massachusetts have set aside smaller sums to help on the work. Both pests continue to advance over an everwidening area, so that it will not be long before other states which now neglect the opportunity of warding off trouble will find themselves engaged in the same battle.

The widest variety of devices for killing off the pests have been put into service. One of the most successful of these was the so-called Hannigan "moth pot," which consisted in the essence of a flaring pot and a quantity of burning crude oil. At first these were set upon the ground in commons and other open places but later they were hung from the mast arms of street lamps, the best location being found to be about three feet back from the arc lamp, measured along the mast arm, and three feet below. Even at this distance, however, the heavy black smoke from the smudge soiled the arm and was in several ways disagreeable.

The Manchester Traction, Light and Power Company had meanwhile been experimenting with an arc lamp arrangement to accomplish the same ends as the moth pots and the accompanying drawing shows the type of globe which was finally adopted after considerable experimenting. It is used on General Electric 72 volt, 7½ ampere, series alternating arc lamps, fitted with clear glass inner globes. From the drawing the glass workers manufactured a mold and from this 605 of the special globes were cast. By the terms of the contract, the electric light company was to cart these globes to the lamps, put them on, take away and store the regular globes, empty the globes daily, keep track of the quantity caught and, at the end of the moths' flight, replace the old globes and store the special globes until the next year.

The globes were put on with the cut away part up, so that the moths fluttering around the light would fall into the bowl. The first gathering was made July 8. The flight, which usually continues about eight days, this year lasted fifteen



ARC LAMP BOWL USED IN ELECTROCUTING MOTHS

days. Between July 8 and July 23, there were collected from the globes 107 5/16 bushels within the city and 12 7/16 bushels from the globes placed at two of the summer resorts.

Two different quarts were counted, one moth at a time, and it was found that there were just about 1,600 moths to a quart. Of these about two-thirds were females. This fact could easily be determined from the moths as taken from the globes, but careful observations were made of those which thickly encrusted the street lamp poles, trees, sides of buildings, etc., and gave good evidence that this percentage was accurate enough for all purposes. In a bushel there were, of course, 51,200 moths, according to these figures, or 5,494,400 in all. If 60 per cent were females, the figure would be 3,296,640. In a year the development resulting

from the eggs deposited by each female would be about 400, so that if the quantity mentioned had not been destroyed in the electric light globes, they would have produced in excess of 1,318,656,000 other moths to get busy on the trees in 1913. Adding to this figure the number that would be developed by the females captured at the two summer resorts, Lake Massabesic and Pine Island Park, the total of 1,474,560,000 is reached, a truly astounding figure.

In collecting the moths from the globes, the lamp trimmer simply placed his hand over the opening at the bottom, removed the globe and dumped the contents after measurement into a two-bushel bag of close woven goods. Measuring was done by means of a ten quart flaring pail, suitably marked on the sides. The condition of the employees who attended to this job was shocking, as they were covered with rash from their toes to the top of their heads. Some of them found it necessary to bathe in creoline of strong yellow soap baths five or six times a day.

When thrown loosely in, such a globe as that shown would hold about 10½ quarts of moths. However, after a globe got about half filled the moths seemed to stew from the heat of the lamp, so that about half way through, the heap would be wet and at bottom "muddy." Several of the inner globes gave way under the confinement of the heat and were badly distorted and discolored. Sometimes the globes would be so full that the moths would be heaped up and on most of the heavy catch days they were almost full to the brim. From the globes the moths were taken to one of the generating stations where they were thrown into the furnaces and burned.

The theory upon which the device works is that the globes shall be cut off at such a height that the moths can easily fly inside but be unable conveniently to fly out. The shape shown was found to be best when used with the regulation type of obtuse angled reflectors. Examination of the moths when taken from the globes showed them not to be badly burned, except occasionally on the head. Death seemed to have resulted from general suffocation from the intense heat or from impact against the walls of the death chamber.

The mold is now at the glass factory and any public service corporation or municipality can obtain the special globes at the same price as the regular type, as the mold has been placed on file.

Linking the Links of the Long Distance 'Phone

By Felix J. Koch.

Taking Cincinnati as a sort of central point for the country, they told me, last August, that the farthest one could talk by long distance telephone to the east, was to Portland, Me. There isn't direct communication to Halifax, because the traffic hasn't so far seemed to warrant it. The longest "talk" in the country at present is New York to Denver, just a little trifle of 2000 miles. It will cost you $7.75 for three minutes talking from the Queen City to Denver, and $2.75 for each minute additional. New York to Denver is about twelve dollars. To the south, you can talk to New Orleans and Gulf points; to the north Michigan and Montreal.

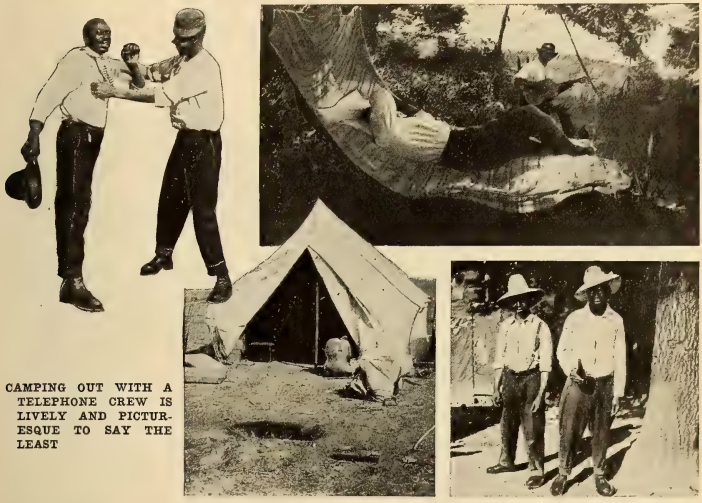
Two thousand miles though is today about the limit of transmission. Were the telephone rates as low as the telegraph rates what a "gab fest" the United States would enjoy!

Most of the heavy trunk lines, one of the superintendents of construction work told me, are now done as far as the present development of the country warrants. One of the last to be completed was that from Topeka to Denver. Meanwhile the country is dotted with the construction camps of the crews that are putting up the connecting links of the great system —cross lines and branch lines. On a heavy line, there will be about 100 men to a camp, and this camp is then split up into three sections. That is done because the line is likewise built in sections, instead

of starting at one end and working directly toward the other.

Of course what constitutes a camp and how its men may be "fixed" depends largely on its location. Material is shipped in usually from two or three central points. As a rule a car is loaded up and sent out. Whether it be a heavy winter or a short winter affects both the like, and where heavier poles are required than on one long, steady line.

Camping out with a telephone crew is the jolliest sort of work for some young electrician, even though the work is hard. In the far west they still have a wagon outfit which is taken right along with them—four sleeping wagons, a kitchen and an eating tent. Throughout the



CAMPING OUT WITH A TELEPHONE CREW IS LIVELY AND PICTURESQUE TO SAY THE LEAST

work and the men, and also the degree of rush to the work.

But there is a chapter of the story to be told even before we come to the camps. Two or three men drive or motor through the country and decide on the route for the line. Following them come surveyors, engineers who stake out the exact location. Two or three men will work together at this sort of thing.

Close on their heels come the men who check up, who determine the size of the line and the nature of the poles. Often, looking at it from their still more practical view point, they are forced to change the route selected by the others, particularly where this crosses ravines and the South and in part of the mid-west negroes are employed on the work, and life around their camp is lively and picturesque to say the least.

Where work is apt to take some time the innate want of a home by man will lead the men often to desert the tent and erect shanties, tar-papered over. In these they eat, drink and sleep when not busy upon the work of construction. As a matter of fact, the camp is apt to preempt all the best woods and groves, and there beneath the trees, men swing in their hammocks or thrum the mandolin on sultry Sunday afternoons.

It takes all manner of men to build a telephone line, and from the high priced

supervisor or chief of construction, who occupies a tent by himself, the social scale of the camp will descend to the picanniny who is water boy, errand boy and general factotum. Men of these lower ranks are happy go lucky as the gipsies into whose nomadry they have fallen.

Ramble on through the camp, you're only one of many visitors, for the country folk for miles about drive in for a look on the Sabbath. Knowing the engineer's purse to be long and his chances at spending limited, country boys bring in their fattest poultry and dispose of it in short order. Village electricians come out for a talk with the engineer, and while comparatively little electric current is used in telephony, the amount of general electrical information they imbibe from the city engineer is indeed much.

One of the tents serves as horse shed, and outside a huge triangle is hung to serve as general call. In Alaska similar triangles are hung from posts at the street corners in order to summon folk to a fire. Then there is the mess tent and off to one side, sometimes at a little distance, a house may even be rented as temporary headquarters. Mornings the cook sounds the breakfast call and a hungry crowd turns out. Then they work till noon, then eat, then work again till dusk.

Little by little they are building the line of the telephone—on and on and on. The local engineer tells me we'll be able to talk from coast to coast in 1915. Next it will be Edmonton to Mexico City, I suppose.

SHOWING THE EFFECT OF INDIRECT ILLUMINATION IN AN ART GALLERY

Picture Lighting Without Glare

Diffused light, light free from glare, light that does not cause bright rays to be reflected into the eyes, is the kind of illumination most suitable for art galleries, stores, hospitals and offices. Particularly in the art gallery it is the soft shadowless light that gives exceptional results, and these results seem to be most readily obtained by indirect lighting.

The accompanying picture is from a photograph taken at night, the gallery being illuminated by the Alexalite indirect lighting system.

A nonbreakable light diffusing bowl of metal, finished in white enamel, is suspended from the stem of a ceiling fixture which holds but a single lamp. The fixture stem is made in one length only, so that the diffuser is eighteen inches from the ceiling. The three chain suspension permits the bowl to be readily cleaned by unhooking one chain, allowing the bowl to hang by the other two. The candlepower of the lamp to be used is determined by the size of the bowl and the light required. The diffusers are made in styles to suit the surroundings, though the white enamel type is most frequently chosen.

Illumination of Niagara Falls

It is confidently expected that within another year the Falls of Niagara will be illuminated with electricity and that the power of this illumination will be the greatest of any illuminating project in the world. Once, for a few weeks in 1907, the Falls were illuminated, and it was a sight that will never be forgotten by those who gazed with wonder on the mighty waters. Plans now under consideration provide for an illumination four times as great as this temporary illumination.

The plan which has in view the permanent illumination of the Falls of Niagara contemplates two large and powerful batteries of projectors, one to be known as the "Gorge" battery and the other as the "Hill" battery. The Gorge battery will be composed of 20 30-inch projectors, together with suitable apparatus for transforming and distributing the electric current. This battery is to be placed in a niche in the face of the cliff opposite the foot of Goat Island, where its rays of light can play on the face of the American and Canadian waterfalls as well as upon the "bridal veil" that pours over the precipice between Luna and Goat Islands. This battery will also be able to bathe the gorge below the falls in a flood of light. The niche in which lights will be placed will be ten feet high, twelve feet long and twelve feet deep. It will be protected by a set of roller doors to protect the machines and the operators from spray, the lights operating through glass panels when necessary.

The Hill battery will be composed of twelve 60-inch projectors located on the elevation west of the Queen Victoria Niagara Falls park and near the transformer house of the Ontario Power Company. These lights will play upon the upper rapids and the upper stretches of the river and at the same time be converged with the rays from the Gorge battery, intensifying the effect upon the Falls and gorge scenery. W. d'A. Ryan, the illuminating engineer whose plans for the illumination have been practically adopted, declared recently that he had every reason to believe that the project will be carried through during the coming year, and that the Falls will be illuminated by the first of July, next year.

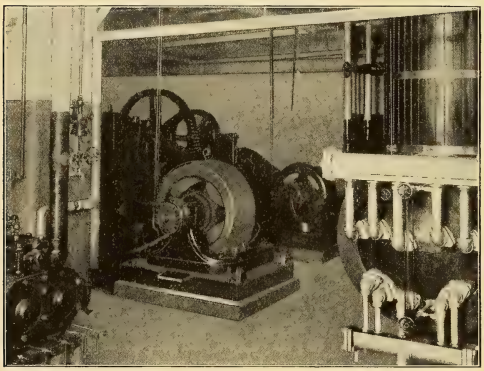
Electric Thermometers

The measurement of temperature by electric means is called electric pyrometry. Such perfection in this respect has been attained that, it is claimed, such measurement is applicable from near the absolute zero—some 490° F. below the ordinary zero—to a temperature of melting platinum, more than 3,000° F. above zero.

Among the methods of measuring temperature by electrical means may be mentioned that which depends on the increase of electric resistance of a pure metal with increase of temperature. Another method depends on the production of an electro-motive force in a circuit of two metals when one junction is kept at a constant temperature and the other is heated to the temperature which it is desired to measure. Many electric pyrometers give a continuous record of the temperature on a revolving drum.

A Cold Storage Plant for Furs

With the coming of summer our grandmothers stored away their furs and winter garments in a way that might now provoke a smile, but was the best method known until a few years ago. Grandfather's tobacco pouch was raided and between each layer of fur a liberal sprinkling of tobacco leaves was showered with here and there a moth ball. Today artificial refrigeration, at an Arctic temperature, has been found to be a destroyer of the germs and insects that our grandmothers had not the facilities to combat.



ELECTRICALLY OPERATED REFRIGERATING PLANT FOR THE COLD STORAGE OF FURS

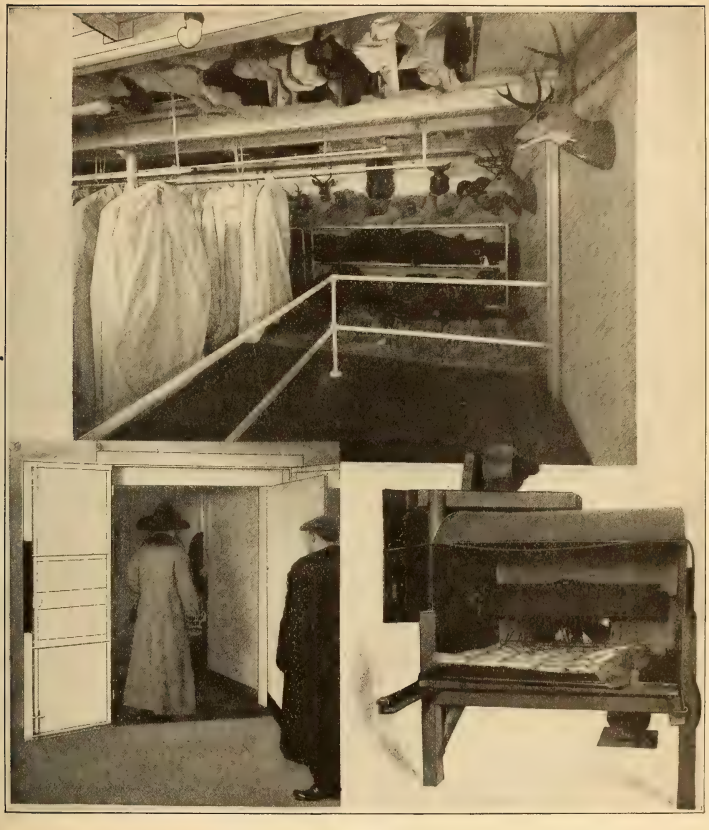
One of the largest fur storage plants in the country, that of Marshall Field & Company, Chicago, has been doubled in capacity within the last five years because of the popularity and efficiency of this method of keeping furs through the summer. Electricity has much to do in this plant as will be seen from the following description.

As the furs are received they are properly tagged so as to be quickly located when wanted. They then go to the cleaning department where a motor driven fur beater and compressed air assist other processes in making them perfectly clean. They are now placed on suitable hangers to keep them in shape and enclosed in fabric bags, ready to be hung in long tiers upon metal rods in the vaults.

The vaults are open to the public and visitors are conducted through them by an attendant. Stepping past the first doorway, a chill is felt in the air, although one is not yet inside the vault. Heavy fur coats or long warm capes are now put on, for in passing through the next doorway the temperature will drop from 70 or 80 degrees of the outside air to twelve below freezing.

Inside the vault, the walls of which are of concrete, cork and steel, a strange sight is beheld. Along the walls are metal shelves filled with rugs, and here and there an animal head with open jaws and gleaming eyes. Furs from every furbearing animal are here — furs from the cinnamon bear and the grizzly, from the mountain lion and the tiger, from the wolf, the mink and the sea otter; furs ranging in value from the inexpensive pieces to those worth thousands. Over to the left in this cold, clean, white place are long rows of coats encased in fabric bags. These coats, however, are not all of fur, for silk opera wraps and garments of delicate texture are also stored in this way. In the darkness and the cold, new luster seems to come back to the fur and the danger of moisture to either fur or silk is entirely overcome.

Above the floor of the vault are row upon row of white, iron rods upon which hang muffs, boas and every product of the furrier's art. There are in all, four stories in the vault, reached by metal stairways and landings. At the



INTERIOR OF THE FUR STORAGE VAULT

ENTERING THE VAULT

ELECTRIC FUR BEATER

top a chilly breeze blows into one's face, for the ventilating pipes enter the vault near the ceiling. In another part of the building an electric motor is forcing a freezing liquid through pipes. A powerful electric fan is blowing 17,000 cubic feet of air about these pipes every minute and the air thus chilled is circulated throughout the vault. At the bottom of the room are ducts through which the air leaves.

The vault described is but one of four. Placed one upon the other they would form the equivalent of a ten story building 30 by 30 feet—an immense refrigerator holding furs during the summer of a value totaling millions of dollars.

A Black Art Entertainment

By T. J. NEWLIN

When you gaze at an incandescent lamp steadily for a few seconds and then look at any other object or even up into the sky an exact imprint of the shape and size of the filament will be seen before your eyes, no matter where you look nor how many times you wink and blink in order to cast the annoying

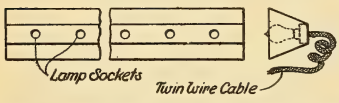


FIG. 1. PROSCENIUM STRIP WITH REFLECTORS

haze from your vision, until it finally passes off from the over stimulated nerve fibers.

This phenomenon is what opticians term "scotomy." It means a dark spot on the visual field. "Absolute scotomy" is a condition wherein the perception of light is entirely absent. Both conditions are the result of a "retinal fatigue;" that is to say, the constant stimulation of the light has caused an insensitiveness for that part of the retina previously occupied by the brilliant, dazzling electric filament.

In dealing with black art the electrician will do well to remember that you sim-

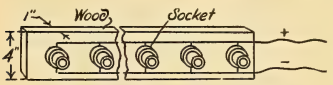


FIG. 2. WOOD SLAT LIGHTING STRIP

ply cannot gaze into the darkness, when an electric pocket-light is suddenly flashed into your eyes, and see anything beyond the lamp. When a "hold-up" or a burglar orders you to throw up your hands, from behind a flashlight, ten to one up they go, for he has the drop on you, or at least you think he has, for as far as you know (not being able to see beyond his flashlamp) he has his gun pointed right at you. On the contrary he may not even have a pistol, but be only bluffing it out, but you somehow or other don't care to prove it or investigate further.

With this little prelude the electrician will all the better understand the idea which is to be carried out in wiring up the parlor, the church or small stage for a few hours' mysterious entertainment in "Black Art," for it is electricity and the laws of light or optics that practically make the illusion feasible.

In order to produce black art the electrician must secure three or four long reflectors say about ten or twelve feet long or build them to fit the shape of

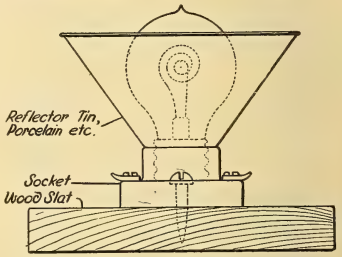


FIG. 3. LAMP REFLECTOR FOR SLAT STRIP

the front opening of the stage or proscenium as it is called in stagedom. Lamp sockets are properly fastened in this reflector and set from ten to twelve inches apart (see Fig.1). Or a reflector can be made and wired up as shown in Fig. 2.

In the latter case, as in Fig. 2, build a long slat of wood of the dimensions shown, to conform to the opening of the stage front or platform which has been built for the purpose. Set lamps

on this slat, spaced as aforementioned, and have the lamps wired in multiple. It is well to have them all controlled by a double pole knife switch set at some position convenient to the operator. On each lamp (if slat style is used) a reflector must be placed as shown in Fig. 3, and both lamp and reflector set to face the audience. The importance of this reflector is to create a glare in the eyes of the audience and simultaneously prevent any light escaping backward into the stage proper, in which case the observers may inadvertently discover the nature faking electrician, and thus spoil the whole illusion. Fig. 4 shows the effect of the glare as seen from the "front."

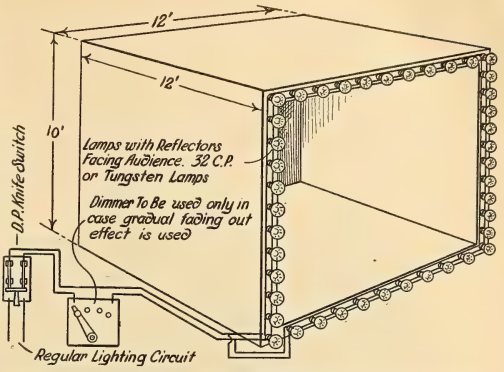


FIG. 4. ARRANGEMENT OF THE BOXLIKE STAGE TO THROW A GLARE OF LIGHT IN THE FACES OF THE AUDIENCE

A nice size for a stage to produce black art is ten feet high and twelve feet wide, but the electrician will do well to judge the illuminating capacity of his light in proportion to dimensions in all cases. The depth of the stage should be anywhere from eight to ten feet, extending backward from the proscenium or light frame. Everything inside of this box-like affair should be either painted dead black, if made of wood, or lined or covered with a dead black cloth so as to reflect no light from within.

When the performer is working on the stage producing the illusions the electrician will see that every other light in the house except his glare frame is turned down exceedingly low by a resistance or dimmer or else entirely switched off, as any outside light is liable to spoil all of the intended illusions.

I will now explain the other essential accessories necessary to carry out successfully the black art illusions. To begin with it requires two performers, the one who stands out front and acts as the magician and the one who is inside of the box or stage and acts as his imp of darkness. The magician is dressed entirely in white, either a flannel or white duck suit, including a white cap. The imp is dressed entirely in black, or he can wear his ordinary black clothes, but he must have a black bag placed over his head.

This black bag is made of some gauze-like material such as cheese cloth or lining which allows the black operator to peer through the cloth while he is working and see everything on the stage and out into the audience. Yet the people in the audience cannot see him on account of the glare of the electric light in their eyes. Anyone who has stood outside and gazed into a lighted room has noticed how easy it is to see the people inside and yet how difficult it is for them to look out into the darkness and see or recognize anyone. While these conditions are actually reversed, the similarity of the conditions remain the same. Even though the imp comes out to the very front of the stage beside the white operator it is exceedingly difficult to see him. But he must be very careful not to pass before the white operator or magician or his whole out-

line will be discovered, on account of the white background thus formed.

In the performance of black art the magician stands out near the front of the stage and by a few passes of his wand causes women to appear and disappear at will, pitchers to spring forth from the darkness while goblets actually rise up in the air to pour their contents in the pitcher or the pitcher to pour its contents back again and vice versa.

Most any trick of this nature can be performed; but nothing in the line of candles or fire tricks can be executed, as the light would show up the imp and the stage settings.

The stage is set for a performance the same as on the regular stage. The table with the pitcher and goblets are all there, the only difference being that each pitcher, goblet, or wineglass is covered over with a black cloth the same as that worn by the imp. If a woman is to be made to appear she also is covered with the black cloth which is suddenly withdrawn at the psychological moment.

The "props" used to produce black art, and which are to be visible to the audience, are usually made of wood and painted a decided white. In fact several coats should be used to insure perfect whiteness, as it will allow the figures they are made to represent to stand out more distinctly when uncovered by the imp at the cue. The objects or props are usually sawed out of ⅞ inch or one inch boards or cut out of tin or sheet iron sometimes and made in the form of pitchers, goblets, oil cans, clocks or anything you wish to bring forth, and painted as explained above. After being set on the table they are covered with the black cloth as aforementioned and are ready for the performance.

FIG. 5. THE IMP AND THE BLACK BAG

In performing the trick the magician dressed in white gives his "spiel" to the audience, telling them of the great mystery he has discovered, informing them he has been in consultation with his Satanic Majesty and will endeavor to please the audience by causing a woman to appear and disappear before their very eyes or make rabbits or cats come

forth and pitchers to pour their contents into glasses and the glasses to dump their contents back or cause birds to fly in the air and go back and forth to their perches, etc.

Everything being in readiness he makes a few passes with his magic wand and behold a most beautiful woman appears. (See Fig. 5.)

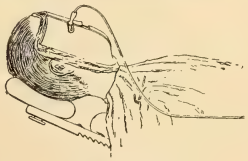
The magician has the woman walk forth to the front of the stage where the audience can see her, then has her return to her place, where she in turn is made to disappear at his command.

In order to perform these tricks the magician goes through a lot of his usual passes and at the finish he utters the magical words such as: Presto! Change! Pass! Appear! etc. The imp who is standing behind, unseen in his black robe, suddenly jerks off the black cloth thereby revealing to the gaping audience the beautiful creature all smiles or the inanimate objects whichever the case may be. When he wishes the object to disappear he utters the reverse words: Presto! Begone! Pass! and lo and behold, there is nothing seen. Of course in this instance the word "Pass" is the cue word at which the imp quickly covers the object with the black cloth causing it to become invisible.

If for instance the magician wishes the pitcher to appear he simply gives the command—off comes the black cloth quickly and there you are. The goblets are now made to appear and he actually makes them lift up in the air, turn and pour their contents into the pitcher. Or if in the form of a bird it is made to fly and perform all kinds of stunts in the air. Of course our imp in black simply stands behind these objects and manipulates them as intelligently to life as possible or carries them from one point to another, pulling off black cloths here and putting them on there, causing the objects to appear and disappear at the apparent will of the magician and much to the surprise and amusement of the audience.

Electric Heater for Face Steaming

An electric heating pad so shaped as to fit the contour of the face is the invention of Alfred P. Blenkner and Bert Z. Smith of Mountain Home, Idaho.



FACE HEATER

The device is adaptable for use in barber shops, massage parlors and the like.

A wet towel is first applied to the face and then the heater laid on over this, generating steam. The heater has double walls, the heating elements being located between the walls. Moreover the heater is adjustable in size and its arrangement such that an air chamber is formed between it and the face, giving a more even distribution of heat.

Electricity and Coal

Certain of the statements made by Professor de Ferranti, in an address before the Institution of Electrical Engineers in London recently, may occasion surprise to those who are not familiar with the facts dealt with by him. For instance, he has pointed out that, taking all the uses for coal into consideration, we are getting, in the form of useful work, much less than ten per cent. of the energy contained in the coal. Moreover, by the present methods, nearly the whole of the valuable by-products of the coal, consisting principally of fixed nitrogen, is dissipated. The suggested remedy is to convert the whole of the coal which is used for heat and power into electric energy, to be distributed over the country from as few central stations as possible, the process of conversion to be performed under strict scientific supervision.

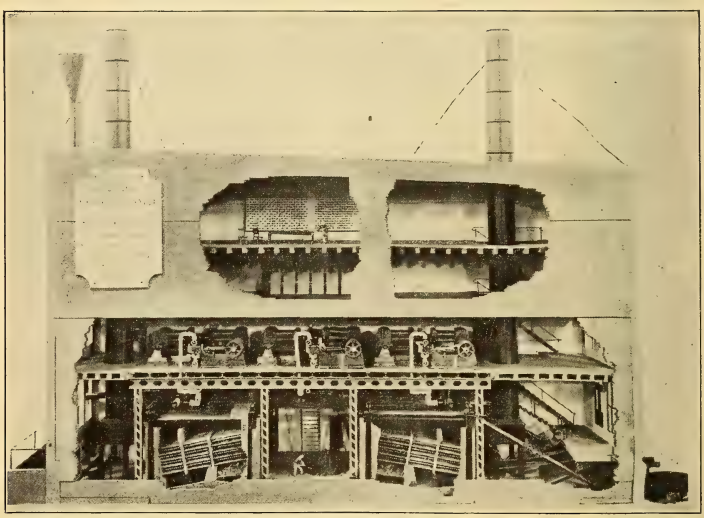
Thirtieth Anniversary of Electric Lighting in New York

By NORMAN MAUL

Through a period of but 30 years is threaded the entire history of commercial incandescent lighting. There are people today who, with hardly a thought of those former days, push a button to flood their rooms with light. Yet the chances are that some of these same people were among the throngs that curiously visited Edison's house on 65th Avenue, New York City, where the first electric lights were burning.

That was in the early '80's, and from that time until the industry had proclaimed itself and was recognized for its true worth many of the chapters of its history are written around New York.

The New York of 1912, with its skyscrapers, subways, trolley cars, automobiles, and lights, realizing full well that without electricity it could not be, has just commemorated the beginning of it all. It is doing honor to those whose genius, strength and courage wrought this change from dark buildings, congested streets, horse cars and all the old institutions that have been cast into the discard during these 30 years.

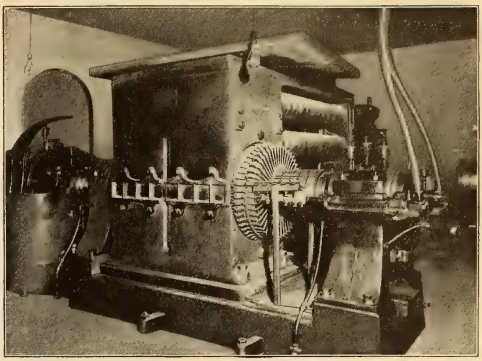


THE OLD PEARL STREET STATION, LONG SINCE DISMANTLED AND SOLD, IS PERPETUATED IN A MODEL WHICH SHOWS ITS ENTIRE INTERIOR ARRANGEMENT

The fourth of September, 1912, was the 30th anniversary of the actual beginning of central station service in New York, for on that day in 1882, current generated by a single dynamo, was sent through a system of underground cables to some 400 lights, and a new industry had come into being.

On that memorable day the generating

plant consisted of a reconstructed brick building at 257 Pearl Street in which had been set up six generating units of the "Jumbo" type. Each of these was rated at about 125 horsepower and was driven by steam from boilers in the basement. The distribution system consisted of fifteen miles of underground cables in a territory bounded by Wall, Spruce and Nassau Streets and extending to the East River. The lamps numbered about 400 on that first day, but they shortly increased to 5,000 on the premises of about 200 customers.



THE ONLY ONE OF THE ORIGINAL "JUMBO" EDISON DYNAMOS THAT ESCAPED THE FIRE OF 1890

Today the generating apparatus of the New York Edison Company is housed in two Bastile like structures that cover two city blocks and the power is rated at that of 700,000 horses; the fifteen miles of cables have extended until now they number 1,300 and reach almost every street in the city and the power sent through them lights five and a quarter million lamps, 40,000 arc lights and drives nearly 400,000 horsepower in motors, while 159,000 meters are required to measure off the current as it flows through the wires.

The lighting company at first was known as the Edison Electric Illuminating Company. It was the New York licensee of the Edison Electric Light Company which held all of the Edison lighting patents, and the New York Edison Company of today is the direct successor of the original illuminating company.

The old Pearl Street station continued in service until January 2, 1890, when fire destroyed the building, wiping out practically the entire equipment. Some of the apparatus was saved, but all the Jumbos with but one exception were lost. The survivor, No. 6, stood near a window, and firemen fighting the flames from the elevated structure that passed the building were able to keep a stream of water on the dynamo and thus hold the fire in check. It was four days before operations could be resumed in that building, but the interruption of service only lasted a few hours, the Liberty Street annex taking up the load. By placing certain restrictions on the use of current all the customers were enabled to have enough light to meet their needs, and this tided the crisis until new apparatus could be installed.

At this time the demands for lighting in the uptown sections had led to the extension of service and generating stations had been opened in three other parts of the city. With the Pearl Street station they made the number of electric power plants in New York four. The old station had been outgrown, however. In 1895 after the new Duane-Pearl Street station had been opened, the old one was dismantled and the building sold. Old No. 6 having yielded to machines of greater power (the youngest of which, with a rating of 30,000 horsepower, has been in service about a year) was placed on the pension roll and is now treasured by the New York Edison Company.

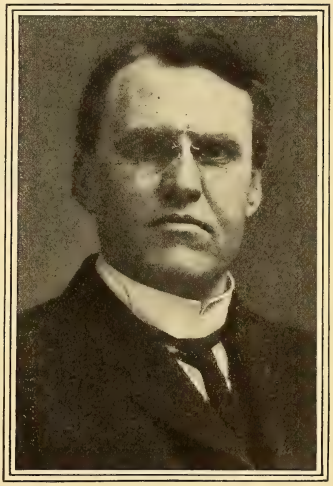
With the exception of this fire, and one other interruption, whose aggregate was less than twelve hours, Edison service in New York has been continuous, a remarkable fulfillment of the inventor's prophecy on the opening day "that the service would go on forever unless stopped by an earthquake."

The original Edison plan called for the generation of current at as many as 36 independent stations south of Fifty-Ninth Street, each with its own steam boiler equipment. However, with the use of the high tension system of transmission which began on Nov. 3, 1898, it became possible to concentrate all the generating apparatus in one locality, and to operate at various parts of the city, not the steam generating stations at first planned, but sub-stations all connected with the central station by high tension cables.

The Making of an Engineer

By M. J. RIGGS, C. E., Superintendent of the Toledo Branch of the American Bridge Company

Extracts from "Addresses to Enginering Students," edited by Waddell and Harrington, consulting engineers. This is the fifth of a series of similar articles by prominent educators and business men, which will be especially interesting to boys and young men who contemplate following the engineering profession.—Editorial Note.



When you look over the field and note what is being done and what is still to be done in the way of taking the forces and materials of Nature and converting and using them to supply the world's needs, to build up society and to help along our best progress and development, you will find that there is plenty of work to be done, and that the engineer is the man who can and should lead and direct the doing of it; and let me say here that for the doing of this work the engineer receives ample reward. From the financial standpoint the efficient and capable engineer receives as much compensation, perhaps, as he would in any other profession or business. His best pay, however, comes from the work itself. There is a great satisfaction in doing things, and the successful accomplishment of any engineering work is a pleasure.

In these days the engineer is the man who is turning the world upside down, and I know of nothing finer or more satisfactory than the building of a Brooklyn bridge, the building and equipment of a modern rapid transit railway system such as the one in New York City, or the putting into successful operation the large steel mills of the Carnegie Steel Company at Homestead, Pa.

If the engineer is to carry on successfully this great work, he must be a first class man, he must be honest. He deals with forces and principles which are unvarying and which of themselves tend to make him honest. He must be honest to himself and to his work. Any violation of these well known laws of Nature will certainly make itself known and result in expense and disaster. He must be honest with his client or employer, since he is put in trust of great interests, both financial and material, and if he is to have the confidence of those for whom he works, he can only have it by strict integrity and attention to business.

There is probably no place in any profession or business for the dishonest man, but of all the professions of which I know, that of engineering has the least room for such men. On the whole, I believe engineers as a class are usually honorable. I have known a few of the opposite kind, and have never known one to succeed and maintain any position whatever.

The engineer must be energetic. His work is to get things done. He receives his pay and holds his position because men with means want to invest it with the idea for prompt returns. There certainly is no place in the engineering world for the lazy man. It is not, how long will it take? but how quickly can it be done, and how well—not how little can be accomplished to-day? but how much—not halfway service, but the very best that is in one.

The engineer must be a man of broad view. He has large things to do in every part of his work, large undertakings to be carried out, large investments of capital to be properly expended; and no small man can do these large things well. For this reason, I think his training at school should not be narrowed down to a specialty, but that he should have a broad culture, one that will help him in these lines and make him fit to do what he must do in life if he is to succeed.

The engineer must keep up with the times; he should not be lazy mentally; he ought to keep fully posted as to what is being done in a general way along engineering lines, and he should have a much better and more intimate knowledge of his own particular line. This he can do by keeping his eyes open and always being quick and ready to adopt any methods which may be better than his own. He should take and read carefully three or four of the leading engineering papers which are published and which are doing an excellent work for the engineering profession. He should belong to the local and national societies of engineers in his line, and should keep in touch with brother engineers, which his membership makes possible.

Lastly, the engineer should be a good man. The qualities which I have outlined necessarily make him a man of power, of strength, and of influence, not only with the men with whom he works, but also in the community in which he lives. These qualities cannot but make him a leader both in social and public life.

A man with all this inherent strength has no business to lessen it and curtail his usefulness and influence by not being a man of good morals, and by not using this strength to build up and help other men. There is no reason why the engineer should be blind on the moral side and every reason why he should be the opposite. I have little patience with the cob pipe, cigarette smoking, beer drinking engineer, and I believe no one else has, and I also believe that the brightest man cannot succeed in the engineering profession who is not also a good man and who is not letting his influence for right be felt by his associates, friends, and neighbors.

Foreign Delegates at American Conventions

One of the great features of international relationship to-day is the extent to which congresses are held from time to time in practically every branch of work affected by modern civilization. It is perhaps in scientific fields that these meetings are more numerous than in any other except, perhaps, medicine and economics; and just at the present time arrangements are being made for a huge international electrical congress in San Francisco in 1915.

Last June the National Electric Light Association held its annual meeting at Seattle. It was largely attended by representatives from the British provinces on the Pacific slope. This convention has attracted a good deal of attention in England, and in a recent issue of the *London Times* the suggestion was put forward that it would be a good thing to send over a representative party of delegates to such meetings. This is the first proposition of the kind for sustained attendance at such gatherings from the other side.

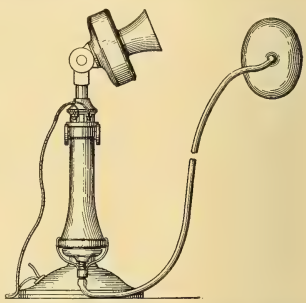
It is a notorious fact that in such matters England falls lamentably behind Germany, whose representatives are always scouring this country for electrical novelties of importance. The *Times* says:

"The growing body of opinion in the British industry in support of the so-called 'forward policy' of the Institution of Electrical Engineers will perhaps in the near future justify a proposal to send over a representative party of delegates to American conventions. The mere reading of newspaper reports cannot convey the psychological effect of these great conferences, and three weeks devoted to one of the Eastern cities for this purpose would be of greater benefit than a decade of municipal electric association Congresses."

It will be an interesting development if such conventions in the future are, therefore, attended annually by experts who have come over to report on the rapid advances in central station work in the United States.

Telephone Attachment

An odd telephone attachment is presented by a patent recently issued to William A. Schmely of Pittsburg, Pa. A cup shaped member fits closely over the earpiece of the telephone receiver, and



EAR ATTACHMENT FOR TELEPHONE RECEIVER

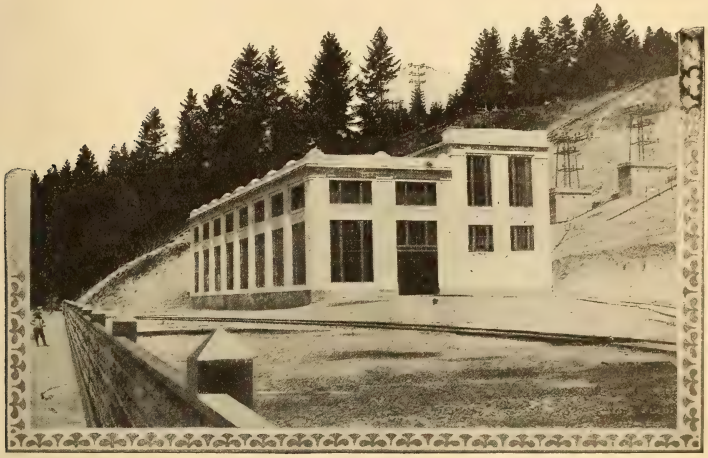
attached to the cup is a flexible tube provided with an earpiece which fits lightly over the ear of the listener, without the necessity of holding it in place. When the receiver is slightly raised from the hook or laid upon the table, sounds issuing from it are carried to the ear through the tube. This leaves both hands free to make notations during a conversation; or, in case some time is required to bring the distant party to the telephone, the caller may go on about his work and listen at the same time.

Niagara Falls is now known as the greatest center of electro-chemical manufacture in the world. The dreams of chemists have become everyday facts. Air and earth are separated into their constituent elements and the products put into neat packages for sale at low prices.

Glaciers Transformed into Electrical Energy

From frozen energy in icy glaciers to electrical energy leaping over the wires at 6,600 volts is the story of the Lake Tapps hydro-electric plant at Dieringer, Washington. White river is fed by the glaciers of Mount Tacoma. Lake Tapps and several lakes, together with masonry dams, will make the total water storage of this project amount to 2,250,000,000 cubic feet, a reserve so great that the widest fluctuations recorded in the flow of the White river would be of no consequence in the operation of the power plant. By canal and tunnel the water is carried through a ridge to the brow of the hill and dropped through the penstocks to the power house at the level of the river 440 feet below. The whole development stretches over fourteen miles of country, much of which is wild and heavily timbered.

The power station is of reinforced concrete, 204 feet long and 82 feet wide. It is remarkable for the fact that the water wheels are said to be the largest horizontal pressure turbines yet built. They are two in number and are rated at 20,000 horsepower each. The outgoing transmission lines aggregate about 10½ miles and are laid out so they connect with the earlier transmission lines of the Seattle-Tacoma Power Company and the Puget Sound Power Company at three points, one near the powerhouse, one at the town of Bluffs on the Seattle-Tacoma interurban line and the third at Sumner.



Telephones in Jerusalem

The latest bit of enterprise in the Holy Land is the beginning of a telephone system over the city of Jerusalem. For the first time in all its long history, the Holy City hears the tinkle of the telephone bell. The new court house at Jerusalem has been connected with the old serai, and the system is to be extended until first all official points, and then business houses and residences are supplied with telephones.—*Telephony.*

Electric Current Rates Defined

In the report of the rate research committee of the National Electric Light Association are embodied the definitions of the various methods now employed of charging for electric service. All service cannot be charged for on the same basis, with equity to both the company and the consumer. Obviously, also, the same method of charging cannot be employed by different companies where the services rendered are widely different. As so many different kinds of rates are employed to fit various conditions, they have become somewhat mystifying to the public, and perhaps these definitions will help to make the terms clear.

Flat Rate: The term "flat rate" is applicable to any method of charge for electric service which is based on the consumer's installation of energy consuming devices or on a fixed sum per consumer. Meters are not used.

Demand Rate: The term "demand rate" is applicable to any method of charge for electric service which is based on the maximum demand during a given period of time. The demand is expressed in such units as kilowatts or horsepower. Maximum demand indicators or graphic meters are used.

Meter Rate: The term "meter rate" is applicable to any method of charge for electric service which is based on the amount used. This amount is expressed in units, as kilowatt hours of electricity. Integrating meters or graphic meters are used.

Consumer's Output Rate: The term "consumer's output rate" is applicable to any method of charge for electric service based on the consumer's output. The unit of the consumer's output may, for example, be a gallon of water pumped, a barrel of flour, or a ton of ice made.

Two-Charge Rate: The term "two-charge rate" is applicable to any method of charge for electric service in which the price per unit of metered electric energy for each bill period is based upon both the actual or assumed quantity of electric energy consumed and the actual or assumed capacity or demand of the installation.

Three-Charge Rate: The term "three-charge rate" is applicable to any method of charge for electric service in which the charge made to the consumer for each bill period consists of (a) a sum based upon the quantity of electric energy consumed, (b) a sum based upon the actual or assumed capacity or demand of the installation, (c) a charge per consumer.

Straight Line: The term "straight line," as used in connection with and as applied to any method of charge, indicates that the price charged per unit is constant, *i. e.*, does not vary on account of any increased or decreased number of units. The total sum to be charged is obtained by multiplying the total number of units by the price per unit.

Block: The term "block," as used in connection with and as applied to any method of charge, indicates that a certain specified price per unit is charged for all or any part of a block of such units, and reduced prices per unit are charged for all or any part of succeeding blocks of the same or a different number of such units, each such reduced price per unit applying only to a particular block or portion thereof. The total sum to be charged is obtained by multiplying the number of units in the first block by the price per unit for that block and adding thereto the number of units in the second block times the price per unit for that block, and so on until the sum of the units falling within the different blocks equals the number of units to be charged for.

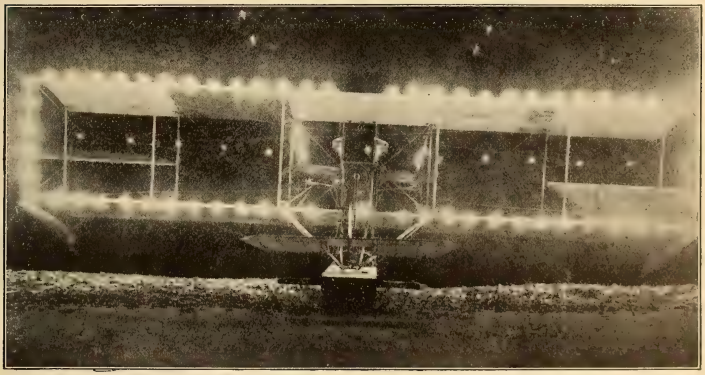
Step: The term "step," as used in connection with and as applied to any method of charge, indicates that a certain specified price per unit is charged for all or any part of a specified number of units, with reductions in the price per unit based upon increases in the number of units according to a given schedule. The total sum to be charged is obtained by multi-

plying the total number of units by the price applying for this number of units, or by the primary price, and deducting the discount applying for this number of units.

These definitions were originally suggested by the Second Public Service District Committee on Gas and Electric Schedules, New York State, and were finally adopted at a joint meeting of that committee and the rate research committee. They have furthermore been approved by the Committee on Terminology.

Electrically Illuminated Waterplane

One of the spectacular features of the annual regatta at Cowes, England, which was graced by the presence of the King and Queen of England and other royalty, including the King and Queen of Spain, as well as many other notables, was an electrically illuminated "waterplane," as the English call it, or hydro-aeroplane. The frame of the machine was studded with incandescent light bulbs, while a row on either side of the engine and a row along the wire struts that hold the planes rigid, were all connected up with the plane lights in one circuit. The lights strung along the wires looked as though they were suspended in midair. A powerful little dynamo operated by the engine of the aeroplane proper furnished the current. As the great machine sailed through the air, over land and sea, soaring high above the Royal Yacht Club, it was a remarkable sight.

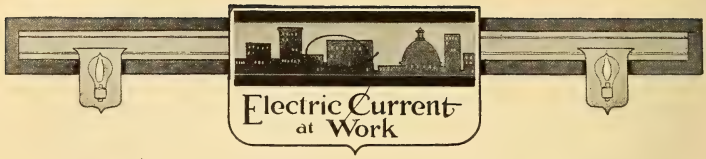


ILLUMINATED AEROPLANE

Canal Boats Propelled by Electricity

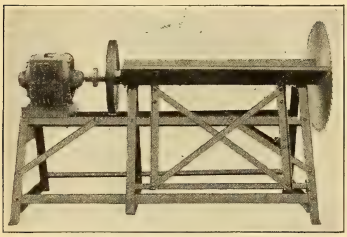
All canal boats negotiating the St. Lawrence River and Welland Canals are expected soon to be fully equipped with electric motors. The electrical supplies and equipments as well as a number of new canal boats, are being fitted out by British concerns. The vessels will be of the usual Canadian canal dimensions and form, with a deadweight capacity of 2,400 tons gross on a draught of fourteen feet.

The machinery will consist of two 300 horsepower high speed Diesel engines, each with its own alternating current generator. The motor deriving current from this generator will rotate the propellers at about 80 revolutions per minute as compared with 400 revolutions of the Diesel engines.



Electric Wood Sawing Machine

Now that winter is coming on and cordwood is to be sawed up into fuel length those who contract for this kind of work will be interested in the electric motor driven sawing outfit developed by Fred. W. Walter, of Norfolk, Va.



ELECTRICALLY DRIVEN WOOD SAW

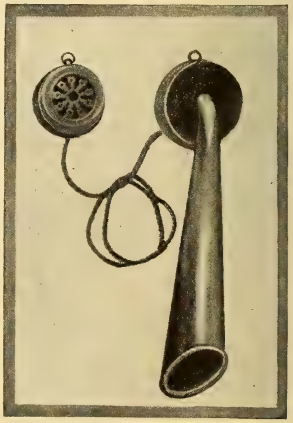
This machine will saw a cord of wood, four pieces to the stick, with one kilowatt-hour of electricity; which at the usual price is about seven cents. This is lower than any other method by from 25 to 50 per cent and cheaper than firing a boiler with free fuel.

The motor is of five horsepower, which has been found to be ample power for the heaviest work and equivalent to a 7½ or ten horsepower motor connected in the usual way. The saw is driven at 1,800 revolutions per minute, which has been found to give excellent satisfaction. The motor is insulated from the frame so that there is no possibility of the operator getting a shock.

The machine is equipped with a fused starting switch mounted on the side of motor, so that operator may stop or start saw without leaving the machine. It may be mounted on wheels and moved anywhere about the yard (current being supplied by portable cable), which in many cases will effect sufficient saving in labor alone to pay for the machine in one season.

Telephone for Motor Cars

One very good use for loud speaking telephones is upon automobiles for transmitting orders to the driver from the inside of the car. A French firm makes a very neat little set of the kind, and the transmitter takes the shape of a small ornamental box somewhat like a watch. It is hung up on a hook inside the car,



MOTOR CAR TELEPHONE

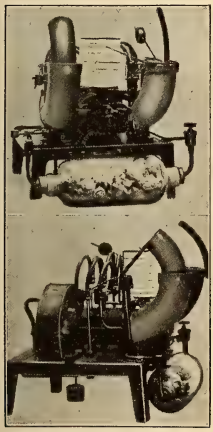
and on the outside is a trumpet attached to a telephone receiver of the loud speaking kind, this being placed just behind the driver. A small wood box for the

necessary dry batteries can be stowed in the car box.

In order to speak to the driver the small transmitter is unhooked and a button on the side of the watch case is pressed, then the person speaks in the natural tone of voice.

Furnace Gas Analyzer

The Poulenc firm of Paris have brought out a very convenient electric device for analyzing and registering the quality of furnace gases, and it is likely to prove of value in many kinds of plants, since it shows what is going on in the furnaces and whether any fuel is being wasted. A small electric motor drives the whole device, and a number of automatic operations are carried out.



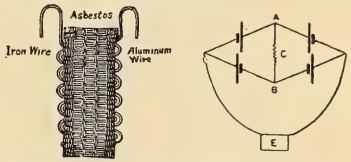
TWO VIEWS OF THE NEW FURNACE GAS ANALYZER

A gas pump in the shape of a rotating cylinder draws in the furnace gas, and then it passes into a measure, which is a curved cylindrical gas holder, rising out of a water bath so as to measure off just 100 cubic centimeters of gas. Then it stops, and the gas is sent by automatic valves into a glass absorbing chamber with pumice stone wet with potash for absorbing the carbonic acid, or with other chemical compounds for absorbing the oxygen, as the case may be. From here, the remaining gas goes to a second gas holder and causes it to rise, but if any gas has been absorbed, this holder will rise to a less degree. This operation makes a dot with a pen on a recording drum. Thus the amount of oxygen, for instance, in any given furnace gas is recorded at regular intervals, taking in a sample at each interval, recording, and expelling to make room for a new one. At the end of the day a permanent record is thus had. The instrument is the invention of W. C. Brenot.

Rectifying Nets

A simple and ingenious device for converting alternating current to direct has been introduced, in the shape of "rectifying nets," by Messrs. C. Schniewindt, Neuenrade, Westphalia, Germany.

These nets are placed in glass jars filled with water, in each of which is



RECTIFYING NETS AND MANNER OF CONNECTING

placed a small quantity of bicarbonate of soda, which are afterwards connected up like cells. The special nets are composed of iron and aluminum wires woven with asbestos.

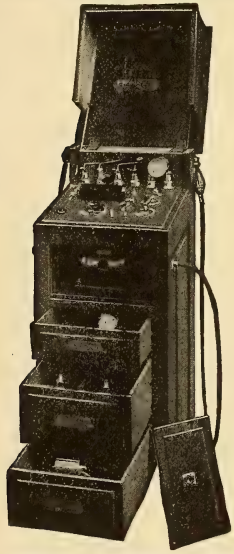
Only that current impulse of an alternating current, up to 100 volts, will be transmitted for which the iron wires are the positive electrodes, so that half of the rectified alternating current is obtained in the circuit as direct current.

By connecting the cells as in the diagram, in which the short dashes represent the aluminum wires, and the long dashes the iron electrodes, it is possible to obtain between the points (A) and (B) a direct current of 75 per cent efficiency, the heating of the electrolyte accounting for the deficiency. (E) represents the source of supply, and (C), the consuming circuit.

These "rectifying nets" can be used for charging batteries from a. c. circuits.

Physician's Electric Cabinet

Every physician knows the value of many forms of electrical apparatus in therapeutics, but also realizes that the



PHYSICIAN'S ELECTRIC CABINET

purchase of each one would involve a large investment of money and expensive storage space.

These difficulties are, however, overcome in the Seibert-Welch cabinet illustrated herewith. This device provides, among many other conveniences, a vacuum apparatus, a hot air douche, compressed air without the use of a tank and vibration upon an entirely new principle. It weighs less than 100 pounds, but places the physician in a position to take care of patients himself whom he would otherwise be compelled to send elsewhere.

The vibration, so essential in modern therapeutics, is obtained by causing air to pulsate against a thin disk or diaphragm at the rate of about 5000 times a minute. This action is claimed to resemble nature more nearly than does any other device.

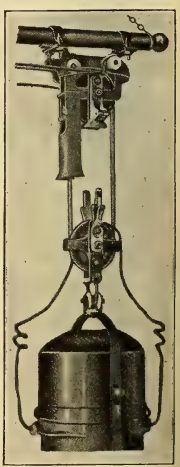
The compressed air and the vacuum obtained are produced by means of a unique fan or blower attached to a 1-10th horsepower Westinghouse motor operating at 1700 revolutions per minute.

Among other electric functions performed by this device are the furnishing of what is known to the medical profession as galvanic, foradic and diagnostic lamp currents when used on 100 volt direct current circuits and sinusoidal, instead of galvanic, current when used on a 110 volt alternating current circuit. The latter can then be furnished through a rectifier.

The cabinet complete with its accessories is made by the Siebert-Welch Company of Columbus, Ohio, and the electric motor for operating the air pump is made by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Cut-Out Hanger for Arc Lamp

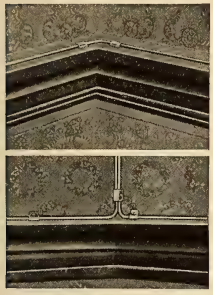
An ingenious arrangement on the hanger of an arc lamp for doing away with the usual slack loops and enabling the trimmer to lower the disconnected lamp to within reach is here illustrated. The line wires connect to the hanger terminals, while on the lamp are two conductor clips that open or close the circuit according as the lamp is lowered or drawn to place. From these clips wires run into the lamp.



ARC LAMP PROTECTED WITH CUT-OUT HANGER

The Stannos Wiring System

Although the cost of electric light has been steadily reduced in recent years, and in spite of the introduction of the high efficiency metallized filament lamps, there are still many using gas or oil, unable to take advantage of the reduced cost of electric light because of the relatively high cost of wiring their homes. This situation drew the attention of the Committee on Residence Business, of the National Electric Light Association, and this committee suggested for consideration a system of wiring used extensively in Europe, known as the Stannos system.



HOW STANNOS WIRES ARE RUN

The component parts of this relatively cheap method of wiring are the Stannos wires and Kalkos conduits which may be used separately or in combination.

Stannos wires consist of single or stranded tinned copper conductors, insulated with pure and vulcanized India rubber (or Unvol, which contains no sulphur) taped and then surrounded by a closely compressed sheet of tinned copper, the whole being rendered homogeneous by a special process, and tested with a pressure of 1,000 volts. They are in effect, small copper tubes which contain the electric light wires, without any air spaces between where moisture can collect. Owing to their small diameter they are particularly suitable for wiring on the surface in situations where value is attached to neat appearance, while if sunk below the plaster they necessitate the minimum of cutting away. Stannos wires are stocked in coils of about 55 yards, and to facilitate erection these coils may be mounted on drums supplied specially for the purpose.

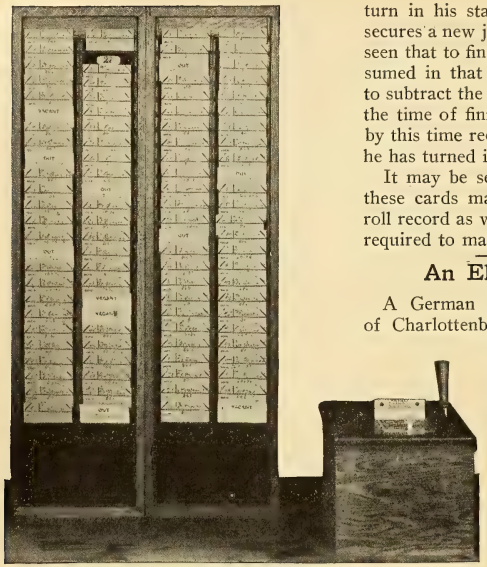
STANNOS WIRES—ONE, TWO AND MULTI-STRAND

For the purpose of obtaining the electrical continuity legally required for a metal cased wiring system (and which is not obtained reliably by steel conduit), Continuity fixtures are mounted on the walls or ceilings at the joint, switch, plug, and light points. The wires are clamped to these plates, which are then covered by the wooded blocks supplied for the purpose, on which standard switches, etc., are mounted. In the case of joints a steel cover takes the place of the wooden block, but where something neater than this arrangement is required, special Stannos watertight boxes are employed. Where the job is required to be watertight throughout, Kalkos boxes provided with adapters for Stannos wires are used for joints, switches, plugs and light points, or the joints may be made in the Stannos junction boxes referred to.

The Periodograph

Each article put out by a factory represents a certain net value in labor and material. It has been possible to find the cost of the material in each article manufactured with comparative ease. But the cost of the labor involved is more difficult to estimate. To fill this need a system of devices, termed Periodographs, which owes its practicability largely to the electric current used in its operation, has been devised.

The system consists of a master clock and any number of time stamping devices or Periodographs which may be installed at convenient intervals throughout the facory. The master clock makes contacts through notches in a disk ten times each hour and through a system of wires operates the dials of the Periodographs located in different parts of the



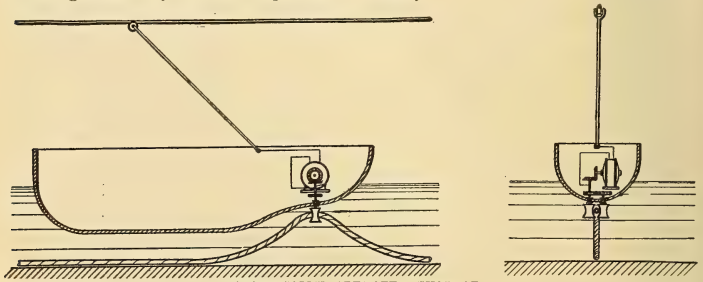
THE PERIODOGRAPH

manufacturing plant. These are so controlled by electro-magnets that their time indicator is moved up every tenth hour and if a card is placed therein and pressure applied to a projecting lever a record of the time will be stamped in ink on the card in hours and tenths of hours. If each workman is given a new card each time he gets a new job, and is required to turn in his stamped old card before he secures a new job and new card, it will be seen that to find the amount of time consumed in that work it is just necessary to subtract the time of commencing from the time of finishing the work as shown by this time recording device on the card he has turned in.

It may be seen readily from this that these cards may also be used as a pay roll record as well as a check on the time required to make each article.

An Electric Tugboat

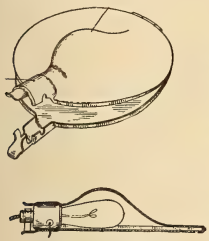
A German inventor, George Meyer, of Charlottenburg, has patented a system of tug propulsion for use on canals. A heavy steel cable is laid in the bottom of the canal and is grasped by two friction wheels depending from two vertical shafts on the boat. These shafts are driven by an electric motor as shown in the drawing, current for the motor being derived from an overhead trolley wire, one being strung over the canal in the line of each of the two paths of travel. In this system, as in the ordinary street car, only one trolley wire is used, the current returning to the source of power through the steel cable in the same manner that it returns through the track rails of a surface railway.



ELECTRICALLY OPERATED TUGBOAT

Incandescent Lamp as a Heating Element

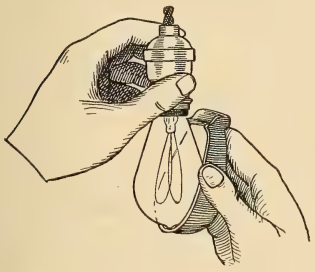
A substitute for hot water bottles is presented by a new type of electric heater invented by Elizabeth C. Donaldson of Detroit, Mich. Two complementary sections of the casing are hinged together as shown in the figure, so as to close down tightly over the base of an incandescent lamp. The walls of the casing absorb the heat from the lamp which is then imparted to the body from the broad under surface. The casing sections are formed of thin metallic disks.



LAMP HEATED PAD

Adjustable Reflector

In the Magna reflector is a simple inexpensive device for directing the light of an individual incandescent lamp to the place required. It is a pear shaped piece of metal covered with baked enamel, white inside and dark green outside. In position it covers slightly over half of the lamp bulb, is revolvable about the lamp and can be quickly removed or put on. The reflector is made to fit a sixteen candlepower carbon filament lamp or a 25 watt tungsten lamp.

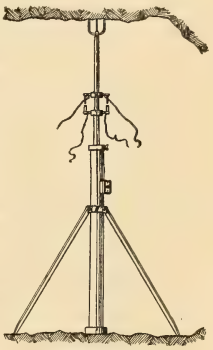


ADJUSTABLE REFLECTOR

Mine Alarm

Ofttimes a "creep" or a movement of the roof in a mine precedes a cave-in. An electric alarm which will give warning is the subject of a patent issued to Henry W. Lee and George H. Weedman, Mount Morgan, Queensland, Australia.

A pair of pipes are arranged upon a tripod. The upper pipe is provided with forks at the top which are adjusted against the roof. This pipe slides into a second pipe and rests against a spring. Contacts arranged as illustrated are closed on the two wires of an electric circuit and bells are rung if the roof moves after the device is set.



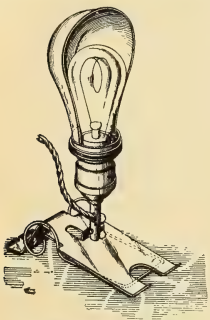
MINE ALARM

Wireless Picture Sending

A young Italian inventor, Bernochi, of Turin, has just succeeded in sending drawings, handwriting and the like by a new wireless telegraph device which has thus far been tried with good success at 100 miles distance between the wireless stations of Turin and Milan, which were placed at his disposal by the Minister of War. It can be adapted to any kind of wireless plant and gives absolutely secret transmission. A point which is well worked out is the synchronous running of the sending and receiving cylinders which operate on the principle of phonograph cylinders by suitable mechanism. In many cases the records on the receiver cylinder were quite clear.

Adaptable Lamp Stand

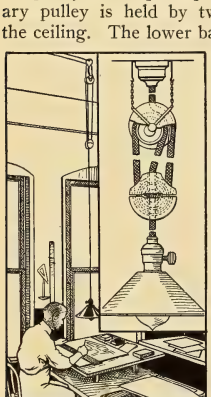
A lamp stand so constructed that it may be attached to the edge of a desk or table, hang evenly against a wall or rest on a flat surface is the subject of a patent issued to John T. Powers, St. Louis, Mo. An adjustable lamp shade may be used in connection with the stand, the shade being revolvable and mounted on the lamp socket.



ADJUSTABLE LAMP STAND

Magna Lamp Adjuster

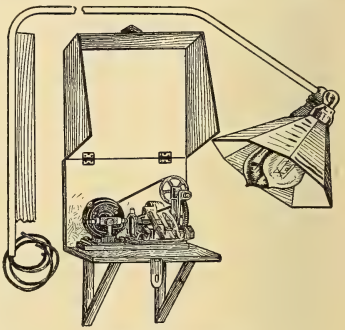
The Magna adjuster illustrated is readily attached to any flexible cord drop light so that it may be raised or lowered and automatically held at any desired height. The device operates on the double pulley tackle principle. The stationary pulley is held by two chains from the ceiling. The lower ball shaped member acts as a counterbalance to the lamp and shade. The adjuster is manufactured in white or dark brown glazed porcelain with nickeled parts with sufficient weights for the counterbalance to hold in place a socket, lamp and shade.



MAGNA LAMP ADJUSTER

Effective Night Billboard Lighting

An apparatus for making an illuminated billboard more attractive by color changing effects is embodied in the Reynolds reflector. This contains lamps of two or three different colors, as may be desired, and a small motor driven flasher outfit, making it possible to change the color of the illumination from white to pink to red, etc., and back to white again. The effect upon the average billboard painted in colors is sufficient to cause a person to read it whether he really wants to or not.



BILLBOARD LIGHT

Electrically Controlled Flashlight Device

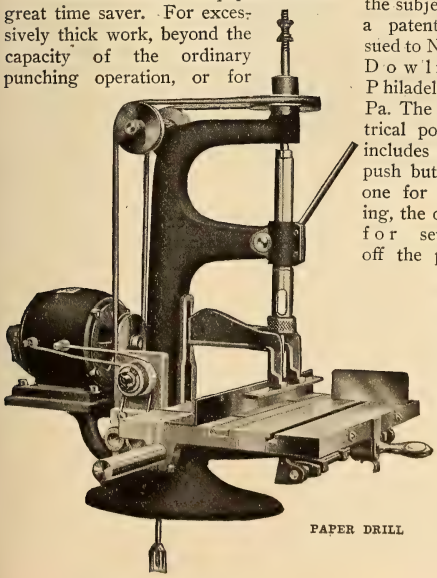
The illustration shows a portable igniting device for flashlights. A basin-like reflector is mounted upon the base which is arranged to contain batteries. One feature of the device is the removable plug upon which metallic filament lamp wire is preferably to be used as this wire has been found to give a large flash and to ignite all parts of a charge of powder practically simultaneously. A push button and cord enable the operator to ignite the powder from any distance, depending upon the length of the cord. A patent upon the invention has been issued to William Bale, Tooting, England,

FLASHLIGHT

Paper Drill with Adjustable Table

The new motor driven paper drill is a great time saver. For excessively thick work, beyond the capacity of the ordinary punching operation, or for holes far from the sheet edge, this machine will be found very valuable and will do work not heretofore done satisfactorily. It is especially adapted for railroad tariffs, telephone directories, order blanks, calendar cards and similar work.

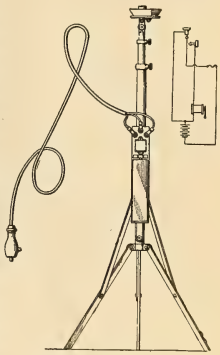
The drills are hollow, insuring clean holes, the capacity varying from one sheet to two inches in thickness. The table is readily adjusted by automatic stops; the clamping device is operated by the foot, leaving both hands free to control the work.



PAPER DRILL

Portable Flashlight Apparatus

A portable, telescoping, foldable flashlight apparatus so made that it may be quickly set up without disarranging circuit connections for employing electric current to fire the powder is the subject of a patent issued to North Dowling, Philadelphia, Pa. The electrical portion includes two push buttons, one for testing, the other for setting off the powder; a battery, and a powder container in the bottom of which are small binding posts. Across these is secured a piece of fuse metal which the current heats and fires the powder covering it. A diagram of the testing and firing circuit is shown.



PORTABLE FLASHLIGHT

Electrical Men of the Times

VICTOR H. TOUSLEY

Good judgment, rare executive ability, congeniality, and being absolutely "on the square," are some of the prime requisites a municipal electrical inspector should have. The subject of this sketch is the happy possessor of all these traits and in exercising them finds himself, at the end of eleven years of service in one department, at its head, directing 45 men engaged in the inspection of wiring.

Victor H. Tousley, chief electrical inspector of the city of Chicago, is exceptionally fitted for the position he holds through the qualifications noted, and is also possessed of technical knowledge and a habit of careful performance of work that the public appreciates, and to which is due the commendable work of the men in his department.

Mr. Tousley is a Wisconsin boy, born in Fond du Lac, 37 years ago. While still a youth, he came to Chicago, was a student in the grammar schools and in the Englewood High School. After finishing the electrical engineering course at the Armour Institute of Technology, he entered the employment of the city of Chicago, doing night work upon the street lighting system.

In 1901 he entered the department of which he is now the head, the Bureau of Electrical Inspection, and at the end of seven years became assistant chief inspector. Three years later, 1910, he was made chief inspector.

Chicago's Electrical Department has charge of municipal lighting, fire alarms, the police telegraph system and the inspection of both outside and inside electric wiring. Inspections last year numbered 77,000. The apparatus subject to the bureau's supervision includes 5,000,000 incandescent lamps, 6,000 electric signs, 50,000 arc lamps and 300,000 horsepower in motors.

There are few men who have given the National Electrical Code more careful study than Mr. Tousley, and were you to enter his office in the City Hall and ask for the Code requirements upon a certain kind of electrical construction, he would doubtless hand you the Code and, while referring you to pages and rules by number, quote the needed information without bothering himself with printed pages.

To the field of electrical literature Mr. Tousley has given five books, in collaboration with Henry C. Horstman, bearing upon construction work and the care and operation of electrical devices. These are: "Electrical Wiring and Construction," "Modern Wiring Diagrams," "The Electrician's Operating and Testing Manual," "Modern Electrical Construction" and "Modern Illumination," the last being just off the press.

Mr. Tousley has been president of the Western Association of Electrical Inspectors. In the revision of the National Electrical Code he was a member of the electrical committee of the National Fire Protection Association.

Electricity as an Aid to Health

That the modern house of the near future will be equipped with electrical apparatus which will, without the inmates knowing it, keep them constantly charged with electricity, thereby warding off many of the ills and aches that flesh has hitherto been heir to, is the prediction made by Dr. John P. Sutherland, dean of the Boston University School of Medicine.

"The use of the high frequency current," says Dr. Sutherland, "does not obtain so widely as might be expected, and physicians in this country have not, for one reason or another, taken it up. To my mind, however, it is of greater value than is generally recognized.

"It has been my experience that the apparatus is of value especially in the non-infectious diseases, such as rheumatism, nervous indigestion, headaches, general debility and the various other ailments, most of them chronic, which we have much difficulty in classifying, as well as treating. These ailments arise from what is known as auto-intoxication. These diseases may, in fact, be called chemical, as opposed to biological—that is, arising from germs.

"The human body is a laboratory in which are constantly occurring a number of chemical changes. For instance, when starch is taken into the stomach it is changed first into dextrine, then into glucose, and finally into sugar before it can finally be assimilated by the blood.

"This is an example of the chemical changes which are constantly occurring in the human system. These chemical changes are closely related and interrelated. In fact, it may be said that in the human body there is always a chain of chemical changes occurring. Now, provided any one of the links of one of these chains is broken—that is, if any one of the functions becomes out of order—we get a condition which probably brings on some ailment or other.

"Although the effect of the high frequency current and of electricity in general upon the human body is not altogether understood, it is safe to say that it has a decided effect upon these chemical processes. The current stimulates the action of the various excretory organs, enabling them to pass off the waste matters, and this is one of the most important functions of the healthy body.

"The body absorbs electricity from the high frequency currents, it may be said for the sake of illustration, in a manner not unlike that in which the storage battery receives its charge from a generator.

"In the future there will probably be a more extensive use of this form of high frequency current. Possibly it is preferable for a patient to be under the influence of the machine at a distance, even though the effect be slighter during a given length of time, than for him to take direct hold of the metal terminal of the machine.

"Much, then, has been done with the high frequency current, and much is still left to do. The man who perhaps deserves the most credit for providing this apparatus is Mr. Earle L. Ovington, now an aviator, who first opened the field for the high frequency apparatus.

"In the future it may become customary to sleep in an atmosphere charged with high frequency waves, just as we now recognize that it is beneficial to sleep in a room in which there is plenty of fresh air."

Illuminating the Thermometer

In winter months porchlights are seldom used for any purpose other than for a moment or so in illuminating the steps leading therefrom and a very practical use for it, is for the illumination of the thermometer on the porch. This is readily accomplished by using an extension lamp connected to the porchlight socket and hung in place near the thermometer.

It is a decided luxury in the dark midwinter mornings to turn on the light from inside and read the outside temperature, without going out into the cold, so as to dress accordingly.

Electrical Interests of Women

EDITED BY GRACE T. HADLEY

Electrical Shops and Shopping

Electrical shops where electric heating and cooking apparatus is sold are a comparatively new development in the field of electrical industry. They are most attractive, and the wares exhibited for sale are unusual and unique. Purchasers often have to be convinced that electric heating and cooking apparatus is notable for the sanitary conditions its use promotes, the cleanliness it maintains, the flexibility it offers, and the safety it insures.

Shopping in one of these modern electrical shops is both interesting and fascinating. The former industries of the kitchen, done so tiresomely by hand, are

THE MODERN ELECTRICAL SHOP IS INTERESTING, EVEN FASCINATING

heating apparatus is efficient and practical, but once convinced, a good customer is the best advertisement. The first cost of the apparatus often seems excessive, but its durability must be taken into consideration, and the scientific skill necessary for its proper construction. Electric heating apparatus is now combined in one modern piece of apparatus such as the electric kitchen cabinet, which has devices for grinding coffee, beating eggs, paring potatoes, mixing bread, freezing cream, all done by means of cunningly contrived motor driven appliances. The electric portable

power table is smaller and more compact than the kitchen cabinet, but offers the same variety of devices, which all help to solve the servant problem.

In the new electrical shops, neat, tidy maids demonstrate the use of the various devices, while competent salesmen explain the efficiency, value and practicability of the electrical merchandise.

Quad Electric Stove and Fireless Cooker

Electricity is the ideal heat generator. It is absolutely uniform in its intensity and it is always under control, that is, it can be turned on or off at will. The fireless cooker is the ideal means of using heat for cooking, first, because it uses all the heat that is generated, and second, because it does the work without constant watching. A glance at the equipment herewith illustrated will show a device that utilizes all of these advantages. Just a round base in which is contained an electric stove to generate the heat, cooking utensils to set on this stove and a fireless cooker hood to fit down over them and use all the heat generated.

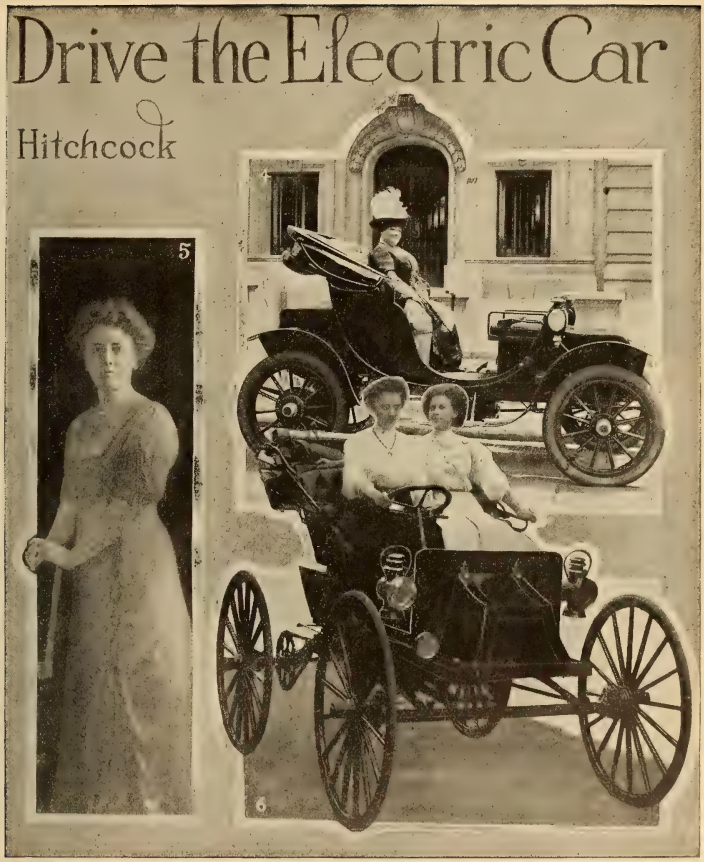
Here is an electric stove, a fireless cooking cover, four vessels of aluminum and six feet of connection cord with socket, plug and three heat switch. It is a cook that never frets, worries or complains and is never too tired to get an extra meal. Getting breakfast is an easy task indeed with this outfit. Oatmeal, for instance, can be put in at bedtime and taken out thoroughly cooked in the morning. When the cooker hood is removed, the electric stove will still be warm. Switch on the current just a few minutes and a pot of coffee may be boiled or bread may be toasted and eggs fried right on the stove plate.

In this device the oven fits down tightly over the heating surface of the electric stove. The walls of the oven being insulated, all the heat is retained and used. And through the glass door, the progress of the baking may be watched without exposing the food to sudden drafts. The shelves are removable so that space can be made for the largest roast or three dishes can be cooked at the same time. The stove for the oven is supplied with a three heat switch so that after baking begins the heat can be maintained at the point desired, with a minimum consumption of electricity. There is also a time clock arrangement for switching off the current.

THE NEW QUAD ELECTRIC FIRELESS COOKER

(1) Mrs. Harry L. Keats and daughter Mildred of Portland, Oregon, in their car which took first prize in the Rose Festival Parade. (2) Mrs. C. Y. Kenworthy (driving), member of the Electric Automobile Club of New York, just returning from a 45 mile spin. (3) Mrs. Clarence Udell Townsend of Seattle, Wash., a prominent woman who is devoted to the use of her electric car.

The woman who is socially busy is enabled, by the aid of the electric motor, to cover just about three times the amount of territory in comfort that was formerly accomplished with effort and fatigue. She does not have to depend upon a chauffeur. She can wear her smartest and daintiest frock and it will not become soiled. She does not have to strain her voice to carry on a conversa-



(4) Mrs. John H. Hannan, a social favorite of New York, just leaving for a shopping trip from her home on Fifth avenue. (5) Mrs. William Howard Taft, first lady of the land, who drives an electric car and is one of its most ardent advocates. (6) The Misses von Brunberg of Berlin in their electric. Incidentally this shows a type of electric runabout not frequently seen in this country.

tion with her companion because there is no noise. All these things appeal to a woman, and there isn't a woman who ever rode in an electric motor car but hopes that some day she can guide her own car down the boulevard or through the parks.

It is difficult to overestimate the value of the electric car from the health standpoint. That it is a wonderful stimulant

to vitality and a cure for nerve troubles is a certainty; physicians invariably speak in the highest terms of the beneficial results derived from the use of the electric motor.

The ozone which is driven into the lungs by riding in a motor car at a fair rate of speed is a specific cure for insomnia and other nervous troubles. Sanity and level-headedness, together with healthy living, have come to those who have found it possible to live a good share of the time in their cars.

The woman whose social duties are many and make a great demand upon her vitality should take a spin in her electric car as often as she can possibly do so, no matter how short the spin may be. Motoring is most effective in breaking up stagnation of mind and body and sending a healthy vibration through the system.

Women of social and intellectual prominence in every state and every city are taking to the electric, and indeed it is in a great measure to women that the remarkable development of this type of vehicle is due.

The First Thanksgiving Week

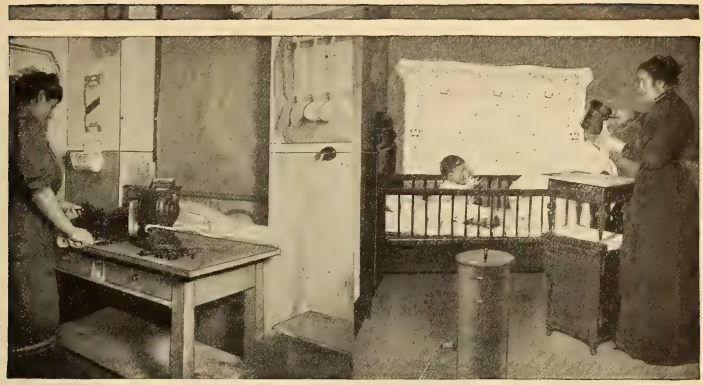
Progress has been so rapid that present achievements seem almost incredible. Today the electric current furnishes illumination and also provides innumerable means of lightening labor and making life more enjoyable. A quaint book of colonial life gives a picture of the first Thanksgiving week in bleak Plymouth in the year 1621, when "the four women of the colony, with the help of one servant and a few young maidekins, had to prepare and cook food for 120 hungry men, 91 of them being Indians with an unbounded capacity for gluttonous gorging unsurpassed by any other race. Doubtless the deer and possibly the great turkeys were roasted in the open air. The picture of that Thanksgiving Day, the block house with its few cannon, the Pilgrim men in buff breeches, red waistcoats and green or sad-colored mandillions; the great company of Indians, gay in holiday paint and feathers and fur, the few sad, overworked, homesick women in worn and simple gowns with plain coifs and kerchiefs, and the pathetic handful of little children, form a keen contrast to the prosperous, cheerful Thanksgivings of a century later." It was in this same year that Governor Bradford wrote, "beside water foule ther was a great store of wild turkies." Later on the supplies in the larder of the early colonists included such dainties as samp or hominy, eels with herbs, joll of salmon, honey, curds and cream, "pumpion pye" and fish and cranberries were plentiful.

The chief means of illumination in those early homes was the glow from the kitchen fireplace, supplemented by a few flickering, sputtering tallow candles. Now the modern Thanksgiving table may be beautifully decorated with chandeliers or candelabra containing tiny electric opalescent globes and illuminated garlands.

Electricity in German Homes

While the United States has been a world leader in much electrical development work, such as the manufacture of arc lamps, incandescent lamps and telephones, still when it comes to the practical application of electric power to the small farm and the small home, Germany is in the lead. There are several reasons for this: the average farm in Germany is small, and the farmer must practice intensive cultivation; then, too, these farms are often quite near some town with an electric light plant from which electric current may be purchased.

A plan adopted abroad is to install a rural central station to supply a number of farms, country homes and rural industries. In Germany, as many as 100 to 150 consumers are supplied with electric energy from one of the numerous rural central stations. Thus it follows naturally that the German hausfrau finds the electric current a handy helper in



DOMESTIC MOTOR IN THE GERMAN KITCHEN MILK WARMER AND ELECTRIC HEATER

ELECTRIC COOKING AND IRONING IN A GERMAN WORKINGMAN'S HOME

the performance of household duties. In a family of modest means, where there are several children and much work, the electric flatiron eliminates the drudgery of ironing and makes it a less tiresome task. The mother has more time and strength for other duties.

Considering that she has five meals to prepare in twelve hours, electricity becomes a most efficient aid. The first breakfast is served between seven and nine in the morning, and consists of coffee with or without rolls; between ten-thirty and eleven, there is a second breakfast or simple luncheon of sandwiches, sausage or eggs, with wine or

beer. In the middle class household, dinner or mittagessen is served between one and two o'clock. Soup is an essential and a skilled hausfrau will see that the same kind of soup does not appear too often. Hot dishes are also necessary and a good deal of care is bestowed upon the preparation of vegetables. Fruits and conserves are used as a dessert. At four in the afternoon, coffee and cake are served, while at eight o'clock supper must be ready, and a very substantial meal it is, with cold meats both fresh and cured, fish salads and the heavy but very nutritious rye bread with tea or beer.

Among some of the middle class families several old customs are observed at table, as when the guests take their seats a genial "May you dine well!" is spoken, and at the end of the repast, "Blessing on the meal!" followed by handshaking and mutual good words of cheer.

Electric utensils, the milk warmer and a cylindrical electric heating stove, are often to be found in humble homes, and the household motor for polishing the silverware and for sharpening knives. All these handy appliances are in daily use in many middle class homes in Germany and make increased comfort in the small German home.

Electric Cooking in a Modern Hotel

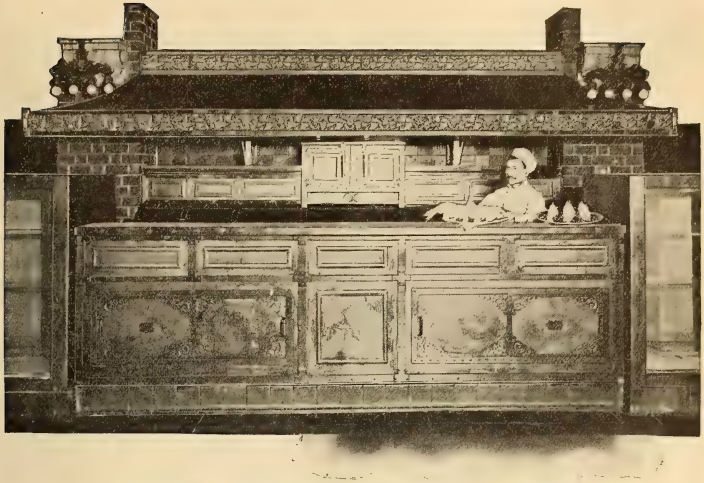
"Electricity is far better than gas for cooking purposes," said Mr. Frank Cucco, chef of one of the leading hotels in Chicago. He ought to know since he is a culinary artist presiding over a fine, modern electric range in the grill room of the Hotel La Salle. This room is open to the public during the winter season and is very popular, since every bit of food served is cooked to order. There are no "ready to serve" specials. In front of the electric range is a counter equipped at both ends with a plate glass refrigerator wherein are displayed samples of the fish, game and poultry. Large glass bowls filled with water show live brook trout to the best advantage and offer a potent appeal to the most fastidious appetite. Prospective diners whet their appetite first by taking a look at the toothsome edibles on display and then select whatever appears most appetizing.

An artist in domestic science once remarked that every dish that comes to the table should make the mouth water merely to look at it, so in this grill room samples are displayed most temptingly and a hungry patron makes a prompt selection: "Chef, broil that trout for me," or "Chef, I like the looks of that lobster," and in a trice the bonny brook trout or the baby lobster is on the electric iron and comes to the table well calculated to make an epicure's mouth water.

"Electricity is safe, clean and has many advantages," declares the chef. "An entire Thanksgiving dinner may be prepared upon the electric range with ease and comfort." In proof of this statement, he offers the following menu:

THANKSGIVING DINNER.

Canape Admiral
Celery Olives Radishes
Pureé of oysters à la Wilson Crackers
English sole in electric iron
Maitre d'hotel butter
Potato Sarah Bernhardt
York ham glacé au champagné
Brussels sprouts saute with chestnuts
Grill sweet potatoes
Pineapple sherbet
Fresh mushrooms Surcloche
Roast turkey, cranberry sauce
Celery à la Moille
Salad de Season
Pumpkin pie Plum pudding
Bombé Surprise Petite Four
Macedoine de fruit, Maraschino
Assorted Cheese
Coffee Crackers



THE HOTEL LA SALLE ELECTRIC GRILL—CHEF CUCCO PRESIDING

The modern electric range is a marvel in its way, with seven large cooking compartments, three double broilers, one each for fish, meat and fowl, two compartments for toasting and two electrically heated plates for the pots of soup. There are a couple of warming ovens above the broilers where plates are heated and the order is served piping hot. A magnificent tile embroidered hood surmounts the whole range and beneath this are a number of electric lights so that the illumination is efficient and satisfactory.

Triscuits Baked by Electricity

The power from Niagara Falls is not only utilized to make candy, chewing gum, chemicals, flour, ice and pure fruit preserves, but the baking of triscuits is done by electricity in a plant near the falls. Triscuits are made of whole wheat shredded eighteen layers deep and subjected to pressure before they are baked. The shredding machines consist of pairs of rollers and a cutting and panning device. Each pair of rolls consists of a steel roller with lines or corrugations cut upon its surface; rolling against a smooth roller the kernel of wheat is caught between the two and rolled out into a long shred, which drops upon an endless belt. These electrically driven shredding machines are marvels of ingenuity and by their continuous operation light porous shreds in threadlike form are deposited on the traveling belt the width of the finished biscuit.

The triscuit factory resembles a huge conservatory with its 844 windows and 30,000 panes of glass.

For the Toast Stove

Use the toaster stove plate turned upside down to form a tray.

Fry the bacon first; then draw the bacon to one side of the tray, and put in the liver cut in thin slices and rolled in flour and peppered. Cook the liver until brown; turn frequently. Serve a slice of bacon with each piece of liver.

Buff Cochins and the Battery

By EVERETT E. LOWRY

In view of the many and intricate applications of electricity the following account is not calculated to stagger the wizards, in fact, it may be regarded by some as a trivial, if not an undignified application of the king of energies. To such, however, as have had to cope with the headstrong hen, when that moulting grandame of the barn yard has decided to set at the wrong time, there may arise a sense of satisfaction to learn that a speedy and permanent cure has at last been discovered for this insane resolution.

THERE IS LITTLE USE ARGUING WITH A SETTING HEN

Speaking of chickens in a general way, it must be admitted that they are quite a nuisance—especially to the neighbors. There is nothing a chicken more thoroughly enjoys than scratching its initials and leaving Bertillon marks among the fresh growing things of a neighbor's garden, thereby keeping alive family feuds and provoking party fence altercations without end. They eat their heads off, are hard to catch when company stays for dinner, and through some secret understanding refuse to lay when eggs are 40 cents a dozen, but they have their good points.

There is little use, however, arguing with a setting hen, or pointing out the fact that she hasn't an egg to her name. She is deaf to reason, although you boost her off the nest a dozen times a day and present her with prickly pears and hot door knobs as foot warmers.

I recently spent a few weeks in a small Indiana town where nearly everybody raised chickens. A family in this town that didn't carry a side line of poultry was hardly regarded as "keeping house." For example, Mr. Brown, my neighbor on the right, was secretly vain over a bevy of Rhode Island Reds, the widow Green on the corner had for years been a victim of the Plymouth Rock habit, while Mr. Blue, who occupies the old mansion situated on the crest of the broad sweep of lawn across the way, had, after careful consideration, pinned his faith to

the Buff Cochin, and it was a pleasant sight in the late afternoon to see the entire herd marshalled out on the lawn for an hour's recreation before dusk.

TAUGHT THEM TO EAT FROM THE HUMAN HAND

Of course the Blues were a little foolish over their chickens, teaching them to eat from the human hand and perform before company, so it was with a decided shock that Mrs. Blue discovered, while in the role of Lady Bountiful one morning, that three of her most trusted charges had gone on strike without even a bean in the treasury.

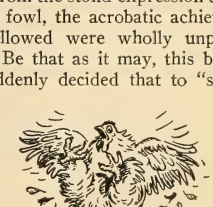
Realizing, after a brief, but one-sided battle, that it would require the services of a hired man to thwart the will of these stalwart fowls, she was about to give up in despair when her son Lebert came to her rescue.

Lebert is sixteen years of age, of an inventive turn of mind, with a penchant for electrical experiments, and it was no time before he had rigged up an appliance that he felt sure would have a stimulating effect upon anything from a hen to a balky horse. The device was simplicity itself, consisting merely of two flat pieces of metal encased in damp cloths, and connected by wires to a spark coil transmitting the genial current from seven batteries.

I happened to be one of the judges selected to witness the experiment (the family having decided to receive returns by telephone), and being somewhat in awe of an invisible force, approached the fatal spot with some hesitation. We found Lebert already on the grounds with the shining eyes of a genius about to prove an invention, and while the committee stood back at a respectful distance he adjusted the plates and made a final examination to be sure no hitch should mar the performance.

When the disgruntled old hen had crept back on the nest, planting a gnarled claw on either plate, she was given an opportunity to state why sentence should not be executed, but remained sullen to the last, and at a given signal the current was switched on.

So far as I know the Cochin has never taken any medals in athletics, and to judge from the stolid expression assumed by this fowl, the acrobatic achievements that followed were wholly unpremeditated. Be that as it may, this bird person suddenly decided that to "set" any



SHE SUDDENLY MOUNTED SKYWARD

longer would be the height of foolishness and an utter waste of valuable time. With one long-drawn-out squawk she mounted swiftly skyward, turned a double back flip-flop, and came down in the nest again all spraddled out with one foot planted squarely on either plate. Lebert promptly gave her the other barrel, and with an-

SCATTERED THE JUDGES RIGHT AND LEFT

other mighty whoop she was again in air, but this time, by rowing hard with the left wing and reversing with the right, she managed to avoid the nest in her descent, and went thumping off down the lot, scattering judges right and left and startling the neighbors with her squawks.

For fifteen minutes there followed a tumult in the barnyard fit to rival a Bull Moose convention, and for the rest of the day this foiled and mystified fowl stood ready to jump four feet in whichever direction she happened to be pointed if a cob chanced to turn under her foot.

The cure was next applied to the other two recalcitrants with the result that each in turn tried to break the standing high jump record. As for returning to the nest again, at last accounts all three hens were still taking their meals standing and seemed too nervous to remain still long enough to do any good. They now spend the days among the jimson weeds in the lower lot, dodging the falling leaves and staring hard at the hen house, first with one eye and then the other.

As an American Boy Sees Switzerland

Readers of the Junior Section will no doubt be interested in a letter received from Roland Richardson, an Ohio boy, who is living at present in Switzerland, and we quote here the major portion of his letter as follows:

"I have only seen one steam power plant since I have been here, about five miles from Neuchatel. Down the lake a little there is a gorge and in that gorge there are three high tension power plants (the Swiss call them "Usine Electrique"). One sends electricity to Neuchatel at a pressure of 25,000 volts, another to LaChaux de Fonds at the same pressure and I don't know where the other one goes. They are all run by water power coming from a mountain called Boudry and you can see these immense steel pipes coming down the side of the mountain. The pipes are about three feet in diameter and two of those pipes run eight dynamos of about 200 K. W. each. In all the cities big and little they have electric lights and use electricity for power. There are transmission lines all over Switzerland and where they run near a little village they tap the wires to transform it down to 110 volts and use it.

We left Neuchatel for three weeks for a little place called Loeche Les Bains which is right down in the mountains. In this little town of about 650 inhabitants there are two small power houses and I want to tell you how they get their power. There is a little brook that is fed by a glacier that runs through the town, and about one-fourth of a mile up the stream from the town they dropped some rocks about half way across the stream. I say they dropped them because it isn't a dam; it's just a few big boulders in the water which kind of side tracked a little of the water into a ditch which ran along a little ways and then into a pipe about eighteen inches in diameter and then down about 200 feet, not straight down, but on an incline

into a little house. I got inquisitive and hung around a little and stuck my head in the door when a big Swiss man called to me to come in and so I did. In there I saw the end of the pipe connected up with a little turbine about waist high and that to a dynamo of about five K. W. capacity and a belt wheel in the middle to connect another dynamo to the turbine if necessary. Then in another room there were 84 cells of storage battery, each cell bubbling and letting off such a smell that I couldn't stay in as long as I wanted to. And here this one man was in charge of this plant and all he had to do was to turn a few switches and read a paper while the water did all the work.

Then there is another one that is still more easily tended to. There is a little stream not more than one foot wide in places and not more than two feet any place that runs along until it gets to a place where it runs into a cement tank about six by three by four feet large and at the bottom of that a pipe running down a hill and into a house. I could only look into the window of this one because there was no attendant, but I saw all there was to see. The pipe was connected to another turbine and that to a dynamo of about 30 K. W. capacity, and it was humming away there at about 800 revolutions per minute with no one to look after it even. And those two power plants light this little town which is mostly hotels, and they use up a lot of juice. They all have Osram lamps over here. Even the oldest, most run down houses that the poorest people live in have electric lights because current is so cheap; it only costs $2.00 per year for a 16 candlepower lamp.

I am an American and I lived in the Southern part of Ohio all my life and I have taken POPULAR ELECTRICITY for three years. One year I just bought it by the copy and another year a boy named Joe Hark and I took it together. The town I came from is named Glendale and this boy Joe Hark and I did all the electric jobs in town and made a good deal of money. We put in door bells, fixed electric lights and everything along those lines.

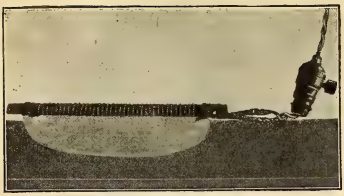
We once, with three other boys, had a telegraph line that was 1½ miles long. We put our telegraph wire on the railroad poles, the electric light poles, the telephone poles and also on the street car poles. We did not mean any harm by it, but before long we had five big rich companies after us and that put an end to our telegraphing. We took to doing the jobs in town and now my pal in Glendale is getting along O. K. and is installing electric fans and telephones just like an expert. I tried to get a job over here, but everything works on the apprentice plan over here and I would have to learn as an apprentice for three years, besides paying 300 francs. As we only expect to stay here for three years and I want to learn all I can in the way of languages, etc., I couldn't accept the position.

In reference to POPULAR ELECTRICITY MAGAZINE I really don't think I could be happy without it, for I can't wait until the end of the month comes to get it and then I don't like anybody to bother me until I have finished reading it. I read it from beginning to end, advertisements and all, and wish it was twice as long and came every week, so you see I have nothing to say against it and lots to say for it.

Electric Fly Killer

Millis Knickerbocker of New Lenox, Will County, Ill., has invented a new way of killing flies. He says it beats the swatter or sticky fly paper all to pieces. He simply shocks the flies with electricity. It is a very simple method according to Mr. Knickerbocker; all the fly has to do is to get in the circuit and it is all off with him.

The fly killer is made of a round grooved piece of wood eighteen inches long wound with German silver wire, the

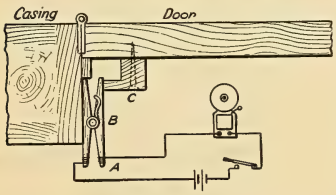


ELECTRIC FLY KILLER

two wires from the lighting circuit being wound in parallel spirals. The ends of the wires at the top of the coils connect with the electric wires in the lamp socket while at the other end of the coils the wires are cut off at even length and not connected. The wire bound roll is placed over a small tin trough or glass bowl filled with water, into which the flies fall, for as soon as a fly touches two wires a connection is made and the victim is quickly electrocuted and falls into the water. No current goes to waste as none is used until a connection is made.

Door Alarm

A switch which causes the alarm to sound when the door is opened can be made with a spring clothespin (B) fastened by one leg to the sash of the doorway. The upper ends of the pins are



DOOR ALARM

first wound with enough bare bell wire to make a good contact when the pin is closed. The wire from (A) must be coiled to allow for the movement of the pin. An L-shaped piece of wood (C) is fastened to the door to break the contact when the door is closed, as shown in the illustration. CARL T. EBER.

Fairyland Discovered

Fairyland! That wonderful region of fancy and childhood dreams has been found at last—found in the soft glow of 10,000 electric light bulbs twinkling through branches of trees and out of leafy bowers—found by nearly 4000 gleeful little boys and girls—and by the photographer, for of course it was necessary to have the picture man on hand to record the great event on his plates or grown-ups might doubt the success of the children's exploits just as they do discoverers of poles.

Strange to tell, it is in the very midst of a great big noisy city full of five millions of people. It is in Central Park, famous for its natural beauty and charming scenery. That is where the children of New York's 42 playgrounds found fairyland on the evening of August 3rd.

The sheepfold, a rolling green meadow of eleven acres, in the heart of Central Park at about Seventieth Street between the Mall and the West Drive, is the exact place where fairyland was discovered. It was the greatest children's pageant ever staged and was witnessed by an audience estimated at 50,000. The fete was arranged and carried out by William J. Lee, Supervisor of Recreation, and his assistant, Miss Mary J. McKenna. The Recreation Bureau is conducted under the Department of Parks, of which Charles B. Stover is Commissioner. Preparations for the pageant extended over a month, 5000 yards of cheesecloth being made into the costumes which the children wore. More than an acre of the sheep meadow was transformed into a stage and roped off. At 6:30 p. m. the pageant of all nations began to arrive, represented by specially costumed delegations from the various municipal playgrounds. Then followed dancing, frolicking and disporting of clowns while the search for fairyland was going on. At length the children becoming weary ranged themselves in a huge semicircle on the green. At 7:30 with a blare of trumpets the King and

Queen of Fairyland appeared in a golden chariot drawn with ribbons by 50 little fairies.

It was at this moment that the most wonderful part of the program—in fact the climax—was reached. The growing dusk and the shadows were making details indistinct when suddenly, simultaneous with the appearance of the King and Queen, the trees surrounding the meadow were transformed into a witchery of varicolored lights. There were 10,000 of them—all eight candle power. They twinkled even from the tops of the tallest trees surrounding the meadow and wrought a fantastic tracery in the dark foliage. The beauty of the scene—the children seated on the green, speechless in their amazement, the lights, the falling dusk—is hard to describe.

A great sign, 21 feet long and three feet high, composed of 129 electric lights spelled out "FAIRYLAND" at one end of the green. There was a giant Maypole, too, the like of which was never before seen. On this glowed 1500 colored bulbs, running in streamers from the top to surrounding points on the green.

There are perhaps a few who realize the difficulties which attend planting an electrical display of this extent in the center of a big park. A force of skilled specialists in this line of work started in four days before the staging of the event.

FAIRYLAND

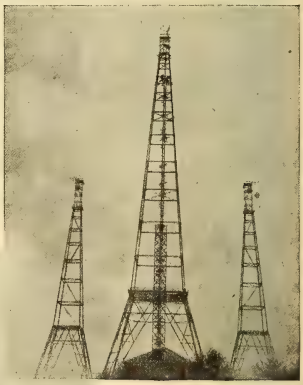
Electric Lighting in Arabia

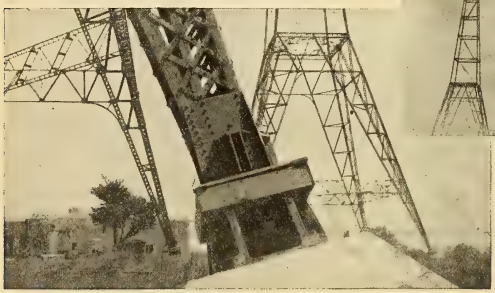
The installation of a 500 lamp electric lighting plant in the palace of the Sultan of Oman, at Maskat, Arabia, has just been completed by N. S. Bayanker. This is the first instance of the operation of any sort of electric machinery in this country. Mr. Bayanker has also secured permission to operate a commercial lighting and power plant and will proceed to erect the same at once, his intention being to use two 30 kilowatt dynamos capable of supplying current for 6000 lamps. One set of machines will be run at night and the other during the day, principally for the purpose of driving fans which, on account of the great heat and the difficulty of securing energetic punkah pullers, are much needed. Power will be furnished by oil engines and direct current will be used.

A World Wireless System for Uncle Sam's Navy

By BERTRAND SHERBURNE

The tallest wireless towers in the world, belonging to the first station of a series of seven, which will cover all of that portion of the world which is visited by ships of the United States navy, are about completed at Arlington, Va., across the Potomac river from the city of Washington. The largest of these towers is 600 feet in height, and it is expected that wireless stations in Ireland and Germany will be within its radius. This station is the controlling station for an ocean embracing system for the United States navy which will be so comprehensive that, when completed, it will put all of the vessels of the American navy in constant touch with one another and the Navy Department at Washington.





TOWERS OF THE NEW GOVERNMENT STATION AT ARLINGTON, VA.

Coupled with the stations of the commercial wireless companies, this system will cover the entire globe. The other six stations are to be located in the following places: Panama Canal Zone; in the vicinity of the great United States naval base, recently opened at Pearl Harbor, Hawaiian Islands; on the Pacific coast, probably not far from San Francisco; island of Guam; island of Tutuila (American Samoa); somewhere on the island of Luzon, Philippine Islands.

The immense strategic importance of this plan is at once apparent when it is considered that it will permit of the issuance of orders direct from the Navy De-

partment at Washington to any United States war vessel. It will make possible the mobilization of the entire United States naval fighting strength in any part of the world as fast as each vessel can steam to the point selected.

The station at Arlington will be the controlling station. Construction work on this station was begun some time last summer, and it is expected that everything will be in running order by the first of November of this year. The general plan consists of three towers—one 600 feet in height and two 450 feet in height, with connecting antennæ and a station building with full transmitting and receiving equipment.

The towers are arranged in the form of an isosceles triangle, the apex pointing west, and the base running due north and south. The base of the triangle is about 352 feet and the legs 392 feet. The towers are of structural steel, with latticed legs, rectangular in section. The smaller towers are 120 feet square and the larger one 150 feet square. Each tower leg is insulated from the ground by a marble slab which rests on a large steel casting, from which bolts pass up through the slab to the steel base of the leg, being insulated from the latter by marble washers. Each slab is designed for an insulating resistance of 150 volts.

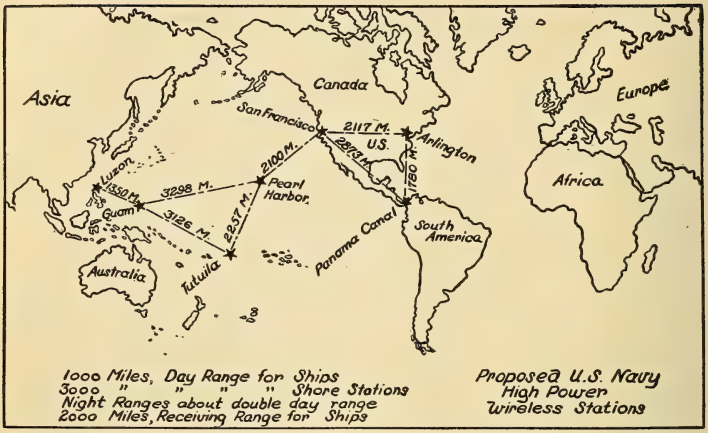
The station house is about 158 feet long and 46 feet greatest width. It is two stories in height. The first floor space is divided into a receiving room, two laboratories, power room, two office rooms, living room, kitchen and store room. The second floor is devoted to bedroom and dormitory space and bath room. The flat roof has a high coping, and is intended to be accessible for observation purposes. From it a fine view is afforded of the Potomac river, Anacostia Heights, and the city of Washington.

The transmitting antennæ consist of three sections, stretching between the three towers in the form of an isosceles triangle. The sections are composed of two groups of wires each. Each group is provided with 88 foot spreaders, and the wires are spaced at intervals of four feet. The transmitting aerial is brought down midway between the two smaller towers to the station building, making a T of this section. A lightning switch is interposed between the aerial and the section entering the transmitter room. The latter enters in the center of a rectangular piece of plate glass, six feet square and one inch thick, which provides ample insulation. The grounding system is very elaborate, being in three sections, one in the form of a gridiron, covering the entire space beneath the building and also a portion of the surrounding ground area, the other two spreading out from each side of the building in the form of a fan. In all, about 60,000 feet of wire is buried.

The receiving antennæ are 20 feet above the transmitting antennæ. The former are to be made up of from one to ten wires, the number to be experimentally determined after installation. The aerials from the receiving antennæ lead down to a lightning switch, and thence through the insulating plate to the receiving room, as in the case of the transmitting wires.

Two different types of receivers will be used, one type for short wave lengths and one for long wave lengths. The receiving room is a sound proof apartment in the center of the building. The walls are made of extra thickness, and are deadened so as effectually to prevent the entrance of external noises. The only means of communication provided the receiving operator other than his radio apparatus is a telautograph which leads to an operator in the adjoining office.

This other operator will be provided with a telephone instrument connecting direct with the Navy Department at Washington, a telephone switchboard for the building and for local calls, and a telegraph sounder and key, connecting with the Postal and Western Union of-



fices, thus permitting the direct transmission of all messages immediately to the land wires.

The transmitter for the station is a 100 kilowatt, 500 cycle generator, direct connected to a synchronous rotary spark gap. This generator is belt driven from a 200 horse power, three phase, synchronous motor, current for which is supplied from the wires of the Potomac Electric Power Company. Current is taken at 6600 volts, 25 cycles, three phase, and transformed down to the 110 volt current with which the motor is driven. About 175 kilowatts are required to drive this motor. It is proposed at some later date to install an oil or gasoline engine, as an additional source of power.

In addition to this high power equipment, there will be various machines for testing purposes, some of which are as follows:

The engine room has been planned to provide for future expansion. The two large testing laboratories will be fully equipped with the latest apparatus. There are two large storage battery rooms.

The dormitory on the second floor of the station will accommodate 24 men, and laundry and kitchen equipment are complete. One of the interesting features contemplated will be the use of two rooms as a wireless museum, in which old and out of date radio apparatus will be on exhibition.

Wireless apparatus for the primary set was furnished by the National Electric Signalling Company, formerly the old Fessenden Company. Contract for the structural work was awarded to the Baltimore Bridge Company and taken over by the Carnegie Steel Company at the time of the recent absorption of the former company by the Carnegie concern.

Officials of the Navy Department believe that this station will have a continuous day and night range of 3000 miles, and that a day communication between this station and the Marconi station at Clifden, Ireland, can be maintained, while the night range is expected to include points as far as Nauen, Germany.

With the seven stations to which reference was made above, it is expected that the Navy Department will be independent of the cable service, and that it will be possible for all United States war vessels to keep in constant touch with each other and with the home office.

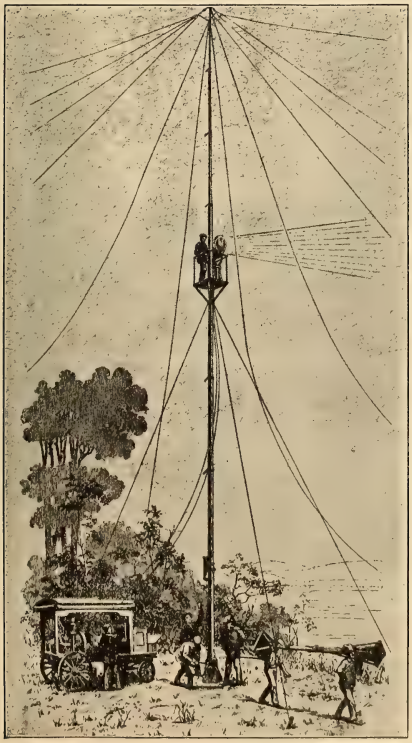
Field Mast for Wireless and Searchlights

The Komet mast is a recent German invention and it can be put to quite a number of uses. When not in use it occupies but a small space, but can be extended so as to reach a considerable height, and this is readily done either by a hand crank or by a small electric motor.

The mast is made up of a number of iron tube sections and these are telescoped by an improved method so that when the sections are slid out, each one is firmly locked in place to make a solid joint. When fully extended, the mast can be stayed by guy wires running to the ground.

In connection with electrical work the Komet mast serves for wireless telegraphy and is very convenient for field use. A searchlight can also be mounted on it so as to explore the surrounding country.

Again, temporary electric lighting of construction work and the like can be very well done by using the masts as arc lamp poles. The mast is well adapted for use with a wireless automobile outfit or again with an automobile electric plant for searchlight use, and it will be valuable in military work in this connection. Many other uses can be found for it. One type of mast is fitted with a small electric motor in the base so that by simply closing a switch the whole mast is slid out within a few minutes, and it can be run in again in the same way. The usual height of the mast is about 100 feet.



THE "COMET" COLLAPSIBLE MAST WHEN RAISED

Proposed Atlantic Weather Bureau

Professor Moore, head of the Meteorological Office, Washington, proposes that a median line shall be established through the North Atlantic, and all ships fitted with wireless apparatus, sailing on either side of it, will be required to take a daily weather observation. The idea is that vessels on the eastward half of the ocean should relay these reports to London and Paris, and those westward of the line to Washington. By a close comparison of the messages it will be possible to estimate the track and speed of storms, to make up a weather chart.

A German Wireless Motor Car

BY OUR BERLIN CORRESPONDENT

The German wireless telegraph company (Telefunken Company) has brought out an automobile wireless station intended to supplement the ordinary transportable military post. Its range is about the same as that of transportable military stations, being between 125 and 155 miles on the level with an antenna mast 80 feet high. Six to eight men, inclusive of the driver, who are transported on the motor car itself, suffice for the operation, the wireless post being put up in working order in 15 to 20 minutes.

In designing the motor car, the Neue Automobile Gesellschaft made a special point of insuring great reliability and high speed. A four cylinder motor of 30 horsepower normal output is used for driving the car and the wireless generator. The body of the car is designed as a limousine, containing the wireless apparatus and the seats for the staff. Its interior is lighted by incandescent lamps fed from a small storage battery, an oil lamp being provided as reserve.

The table on which the apparatus is arranged in a straightforward and readily accessible manner is installed on the front wall, the measuring instruments being fixed to this wall. A window allowing a direct communication with the driver through a speaking tube is likewise arranged in the front wall. On the rear wall is provided a seat for three men, and in the middle on both sides are two officers' seats. The electrical machinery, which is fitted into the chassis below the floor, is readily accessible through doors in the latter. The antennæ, reserve material, and dynamo are arranged

A GERMAN WIRELESS MOTOR CAR

in a fire box at the rear, which is accessible from the inside as well as the outside. All the machinery and apparatus are so fitted into the car that every part is readily accessible, easy to control and immediately ready for operation. In order to pass from traveling to wireless operation it is only required to erect and connect up the antenna system, and for the sake of transmission, to switch the motor coupling into the generator set.

The generator, which can be coupled to the gasoline motor by means of the switchgear, is a high frequency, single phase machine, devoid of collectors and slip rings. Its output is two kilowatts.

The wireless equipment is installed on an apparatus table at the front wall of the car, and partly on the front wall itself. On the right side is seen the sender and on the left side the receiver. Below the table are arranged the condenser and the transformer of the sender, as well as two boxes for tools and reserve materials, respectively. All connection wires are plainly visible, laid out bare on insulators and screwed to the apparatus.

The sender is operated by opening and closing the alternating current circuit by means of an ordinary key. A hot wire ammeter and voltmeter have been provided for measuring the current intensity and tension in this circuit.

The primary vibratory circuit comprises the spark gap, the condensers and the self-induction coil. The spark gap is a series damping spark gap with metal electrodes, which are arranged in an insulated frame. The condensers consist of tinfoil with paraffin paper insulation, fitted into a wooden case; brass terminals are provided at the outside of the case for connecting up the conductor. The self-induction coil is wound from flat copper bands and comprises plug connections for adjusting some given fixed wave lengths. Inside the range of 600 to 1,600 meters any four fixed waves are readily adjusted for by means of a few manipulations.

The antenna circuit is adjusted to the wave length of the primary by means of a set of six antenna extension coils inserted into the antenna and provided with connections for the various wave lengths. The coils are made from flat copper bands.

In order to allow an accurate tuning to be obtained between the antenna and the exciter circuit, the second coil is wound in a direction opposite to the remainder and is movable in a vertical direction, thus altering within narrow limits the mutual induction of the two coils.

After plugging the desired wave length into the exciter circuit and antenna, the movable coil is approached to the stationary coil situated above it, or removed from this coil, until the hot wire ammeter inserted into the antenna shows a maximum deflection. An accurate tuning between the two sender circuits has thus been obtained.

Frenchman Invents New Detector

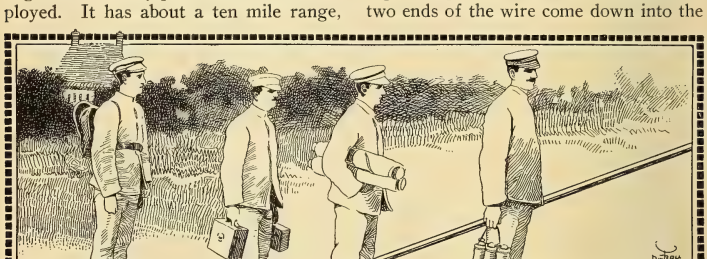
It is stated that a French inventor has succeeded in dispensing with all the outer wires and antennæ in a receiving wireless telegraph system by producing a detector which is far in advance of all others in sensitiveness. The inventor is M. Duroquier, and he made experiments before different persons with his apparatus, hearing messages which came from all quarters. The most valuable discovery is a substance which is far more sensitive than any now in use for receiving the waves, and he thus makes a detector which cannot get out of order and is mounted in a small base of 6 by 4 inches. With an ordinary telephone he heard messages from other countries, even as far off as Ireland, Gibraltar, and other places, and could read the Marconi news bulletin sent out to vessels. All this was done without an antenna and nothing but the detector, the "finding coil" and the head receiver.— *London Electrical Review.*

Great Brazilian Wireless System

A new record for the establishment of a cross country wireless system, has been made by South America republics. Lima, Peru, and Para, Brazil, formerly completely isolated from each other, have recently been hooked up by a German wireless company. The height of the mountains between the two stations is nearly 20,000 feet.

Knapsack Wireless Outfit

The new Marconi knapsack wireless outfit is one which will often be useful in army work, and it can be used for signalling where a heavy plant could not be employed. It has about a ten mile range,



KNAPSACK WIRELESS OUTFIT READY FOR THE MARCH

and the whole outfit is carried in knapsacks strapped to the backs of the soldiers, the complete set being carried by four men, each with a 20 to 30 pound load. The first man takes the mast and the battery, the second the wire gauze network which is unrolled out upon the ground to serve as an earth connection, while the third man has the transmitter and receiver. The aerial gear is contained in the fourth knapsack. An aluminum tube mast about 30 feet high acts to hold umbrella wires going down to ground pegs.

Separate flat boxes contain the transmitter and the receiver, the latter having a carborundum detector and four dry cells. No tuning coil is needed owing to the very short wave length which is used in this case and this is widely different from what other posts use so that there is no trouble from interference.

Wireless Antenna for Balloons

A German inventor, H. Mosler, has been engaged on the question of wireless telegraphy from spherical balloons or airships, and makes some improvements in the method of mounting the aerial wire around the body of the balloon. As before, he encircles the balloon by throwing a loop of wire over it so that the two ends of the wire come down into the basket, but instead of attaching the wire to the network, he first mounts the wire upon a band of stout canvas and then fixes the band to the balloon network in a suitable way. One advantage is that there is no danger that the wire will cause damage to the balloon by cutting it. Again, he mounts the wire loop not directly over the middle, but towards one side of the balloon, so that the wires come into the basket on one side and are far away from the gas valve so that there is less danger of setting fire to the gas by sparks. The antenna is completed by a wire which hangs down from the basket. —*Elektrotechnische Zeitschrift, Berlin.*

How to Comply with the New Wireless Law

Standard Experimental Equipment in Accordance with Regulations

By PHILLIP E. EDELMAN

As a direct result of considerable agitation, pro and con, wise and foolish, a wireless bill has at last been enacted into law. The bill (S. 6412) was passed by the Senate on May 7th, by the House on August 9th, and signed by President Taft on August 17th. It goes into effect after 90 days, or November 17th, 1912.

There is no cause for alarm, however, because the bill, while defining the rights of experimenters or amateurs, does not deny, curb, or otherwise prohibit experimental stations, *provided* that the simple defined limits are observed. The portions of the act which directly concern the experimenter, boiled down to their briefest forms are:

1. The law recognizes the experimenter, gives him rights, and a license will be issued without cost upon application to the Secretary of Commerce and Labor, *provided* that,

2. The experimenter does not use a wave length over 200 meters long for transmission nor a greater power, in either a coil or transformer, than one K. W. if he is farther than five nautical miles away from a government station, or not more than ½ K. W. if he is within five nautical miles of a government station.

3. However, experimenters having apparatus which is not powerful enough to transmit farther than the boundaries of the State in which the station is located, *need not* take out a license unless they desire to do so. For instance, a station located in the heart of Texas need not take out a license provided that stations in other states cannot receive the messages which it sends. Experimenters living near the border of another State, however, will have to obtain a license or else use very weak power.

4. It *is not* necessary to have a license for a receiving station only, *provided* that you do not receive messages from another state. The inter-state feature is particularly emphasized in the bill.

5. While the experimenter is limited to the low wave length and power, the Secretary of Commerce and Labor has considerable latitude, and while he cannot refuse to license stations complying with the act, he can waive the provisions in special cases. Permission may be had upon proper application, showing why additional power and wave length are desired, to use a high wave length or power.

6. The experimenters must use sharp and pure waves. This means that the stations must be very sharply tuned.

7. The operator must preserve the secrecy of all messages sent or received upon penalty of forfeiting his license.

8. The penalty for sending a false message of any kind, will be a fine up to $1,000 or imprisonment up to two years, or both.

9. The penalty for sending out a false distress signal will be a fine up to $2,500 or imprisonment for five years or both.

10. The operation of wireless instruments for either sending or receiving, except as before stated, without a license, will be punishable by a fine of not more than $500 and the forfeiture of the apparatus.

These are the main requirements of the law as far as the experimenter is concerned. The Secretary of Commerce and Labor will very likely have directions and information ready within a short time. A copy of the bill can probably be had from your congressman. Mr. E. T. Chamberlain, the Commissioner of Navi-

gation, will very likely have charge of the matter. Under date of August 13, 1912, he advises the writer that the matter of licensing the stations has not yet been determined. He states, "It is probable, however, that it will be carried out either through wireless inspectors or collectors of customs. No fee will be charged for the license."

The license, being free, is even advantageous to experimenters. All that is necessary and required is that the simple provisions be strictly adhered to. In fact, Richard Roe, Jr., who may only be thirteen years old or so, may well feel proud of the certificate, and the title "Licensed Operator." Manufacturers of experimental apparatus and supply houses need feel no alarm as the interest in the matter will not lag on account of this act. Experimenters, however, must abandon hit and miss apparatus and either adopt or revise their present apparatus to conform to the requirements. The object of the present article is to show how this may be done.

GENERAL PRINCIPLES.

The first item to receive attention is the matter of the low wave length and power. While this low wave length will eliminate the interference between commercial and private stations, the interference between the private stations themselves will not be materially improved even when sharply tuned apparatus is used. The low wave lengths are more difficult to manipulate for selective purposes than the longer wave lengths. The experimenter, then, must use an even increased amount of skill in working with his apparatus. When a number of stations are all working at approximately a 200 meter wave length, it will be practically impossible to greatly lower the wave length, and the use of a higher wave length to escape from interference is restricted to the commercial installations. Where interference of this nature is very bad a system of time will have to be provided so that every station may have a chance. Stations in isolated parts of the country where there are few if any other stations may continue as before without particular concern over the act. The low wave length necessitates the use of the low power because the larger power transformers and coils require a condenser of a size which prevents the use of a low wave length. This is an advantage in many respects as experimenters are, or have been, in the habit of using too much power for their purposes. The use of a low wave length, however, restricts the transmitting range considerably, because the low wave lengths are subject to much more absorption. This effect will be particularly marked during the summer months, and particularly when the station is in the vicinity of considerable foliage, hills or other irregularities of the earth.

With good tuning, however, a small station can be made to give equal or even greater results than a large powered station poorly tuned. The experimenter can easily expect a range of one mile for every ten watts provided the distance is not over 50 miles or so, but greater distances, or even this maximum distance, are not to be expected with short wave lengths when the natural conditions are favorable to absorption. Then, too, the use of short wave lengths makes the "tuning out" of natural disturbances such as static more difficult, since the latter are best eliminated on the short wave side of the circuit. The writer believes that the standard 200 meter wave length will operate most efficiently with stations up to ½ K. W., as although a greater range may be expected by a one K. W. station properly tuned, the increase will be far from a direct proportion. We shall now consider the several parts for a standard 200 meter station in some detail, assuming that the reader has some previous knowledge of the relations, principles and construction of wireless apparatus.*

*For a detailed account giving the construction and operation of standard apparatus in accordance with the new law the reader is referred to "Experimental Wireless Stations," soon to be published by the author. See also, back numbers of this magazine.

AERIALS.

An aerial to coöperate with a 200 meter set must not have an effective length of over 120 or 125 feet. As the effective length includes the lead-ins and ground-lead if of appreciable length, the height for a standard aerial cannot very well exceed 60 feet. The effective length of an aerial is the total distance from the instruments to the aerial proper, plus the length of the aerial itself. The actual length of the aerial itself cannot therefore exceed 75 feet. The flat top type will perhaps be best to adopt for the purpose of standardization, the T type being preferred. A directive aerial is also desirable. The short length can be compensated for to a certain extent by the use of a large capacity. This is accomplished by using a greater number of antenna wires, and while the capacity does not increase in a direct ratio, this method is effective. The capacity, however, must not be greater than the given set can stand. Using a No. 12 copper wire as a standard for the aerial conductor, three strands should be provided for all stations up to 100 watts. (Figure a 1" coil at 100 watts) and an additional conductor should be provided for each additional 100 watts. The wires should be spaced at least two feet apart, all joints should be soldered, and the aerial supports should be preferably of the same height, i. e., 50 or 60 feet at both ends. Such an aerial will be nicely proportioned, have sufficient capacity, and have very little resistance. The large capacity is an advantage in that the transmitted energy is more intense, provided of course that the remainder of the station is balanced accordingly. It is important that the aerial be well insulated, as leakage cannot be afforded.

The lead-in should have an equal carrying capacity to correspond with the capacity of the aerial. Thus if the aerial has four strands of No. 12 wire spaced two feet apart, the lead-in should consist of four strands of No. 12 wire twisted together and connected to the aerial wires. The lead-in should be very short and direct as this is an important factor in securing sharp tuning. It should be very well insulated, particularly at the point where it enters the operating room. The effective length of an aerial should be made 0.6 of the wave length. Thus for a wave length of 200 meters, the effective length should be 120 feet. This is obtained from a simple calculation which need not be repeated here. When the aerial is 75 feet long, the lead-in can not be over 45 feet long, and must even be less when the ground wire leading to the water pipes or other ground, is of appreciable length. The aerial must be shortened or other equalization made if this does not fit in your particular case. This leaves a margin of some 40 or 50 meters for tuning purposes, preferably using a standard helix or oscillation transformer.

This aerial may be used for both sending and receiving in short wave lengths, a longer aerial being desirable for receiving alone. The experimenter is not limited as to the receiving wave length which he may employ, and for this reason a duplex aerial arrangement is desirable. Those having large aerials at the present time can leave same for receiving purposes only, erecting a shorter aerial for transmitting purposes. It is always desirable to make the second aerial so that the least energy will be absorbed by the large receiving aerial. This is best accomplished by placing the transmitting aerial at right angles to the receiving aerial, and well insulated from it. There is one other method of securing a low wave length by the use of series capacity, which will be taken up later.

THE TRANSFORMER OR SPARK COIL.

It will be understood that the use of a good ground is essential to the success of a wireless station, so this item will not be considered. The matter of the power to use is worthy of attention. If a spark coil is used, standardization is not as easy as with a transformer, as the proper capacity to use for a given coil is much

more difficult to determine. A transformer is to be preferred for this and other reasons. Now it will be understood that the source of power, the frequency, and the secondary discharge voltage of the transformer, determine the capacity of the transmitting condenser, and that this condenser in turn determines the wave length of the primary or condenser circuit for efficiency, which in turn determines the transmitting wave length of the station. The transformer and condenser must therefor receive attention first. They form the heart of the transmitting station. A one K. W. transformer requires a larger condenser, other conditions remaining the same, than a ½ K. W. station. This means that for a standard 200 meter wave length, less inductance can be used in the primary or condenser circuit with a one K. W. set than with a ½ K. W. set, since the product of the capacity and the inductance of the circuit determines the wave length. Now a one K. W. set can have only very little inductance in circuit if the 200 meter wave is to be retained with an efficient condenser for the transformer, which means practically that a one K. W. set will not operate with as great efficiency, other conditions remaining the same, as a ½ K. W. set will with a wave length of 200 meters. Of course if efficiency is of secondary importance, the one K. W. set will transmit farther when adjusted to resonance than the ½ K. W. set in most cases. One of the regulations of the bill requires that all stations use *only sufficient power* to transmit the business at hand to the desired station, so that excessive power is really unnecessary for the average station. Nearly every experiment which can be carried on in the art, with the possible exception of absorption tests, can be carried on with power of ½ K. W. or less.

CAPACITY REQUIRED FOR GIVEN SET.

In this and other calculations to be given, there is nothing difficult or which is not within the limitations of every reader. The formulas have been simplified so that little more than simple arithmetic is required. The amount of capacity needed for the transmitting condenser depends on three things, as follows:

1. The power in watts supplied to the condenser.
2. The frequency or number of sparks per second.
3. The secondary discharge voltage.

Now with a transformer the power in kilowatts (1,000 watts=1 K. W.) supplied to the condenser may be represented by P. With an ordinary spark gap and the proper capacity, properly adjusted, the condenser charges to a sparking potential once each half cycle. (The natural spark rate is thus twice the natural frequency, as 120 times per second if the primary frequency is 60 cycles, etc.) Now when the condenser and spark gap are arranged so that the condenser is charged to a sparking potential once each half cycle, the power (P) in kilowatts is equal to $\frac{nCV^2}{1{,}000}$ in which n represents the frequency (as 60 to 25 cycles), C the capacity of the condenser in farads, V the potential in volts to which the condenser is charged at the time the spark begins.

This formula is readily simplified to the following form, which we will use hereafter:

$$C = \frac{1{,}000 \times \text{Power in K. W.,}}{nV^2}$$

the letters representing the same items as before.

Now when the power, the number of cycles per second, and the voltage to which the condenser is to be charged are known, the required capacity can easily be found from this formula. It will be evident that the higher the frequency, the less will be the needed capacity, so that for the same output a smaller capacity may be used for 60 cycles than for 25 cycles, and so on. For larger power

stations it is an advantage to use a higher frequency. To illustrate the use of the formula:

Suppose that the station has been determined and found to have a range of 25 miles, using a ¼ K. W. transformer, operated on a lighting circuit, primary voltage 110, frequency 60 cycles, secondary voltage 20,000. Substituting these values in the formula we get—

$$C = \frac{1{,}000 \times \frac{1}{4}}{60 \times 20{,}000 \times 20{,}000} = \frac{1{,}000 \times .25}{60 \times 400{,}000{,}000} = \frac{.25}{24{,}000{,}000} = .0000000105 \text{ farad (approximately).}$$

On account of the large unit represented by a farad, wireless capacities are invariably calculated in microfarads, a microfarad being one 1,000,000th of a farad. Therefore, to change the result to microfarads, the answer is multiplied by 1,000,000, giving a result in this case of .0105 microfarad.

The calculation is really very simple and is sufficiently accurate for all experimental purposes. We shall see how a condenser is built to secure a desired capacity a little later.

On acount of the lack of uniformity in spark coils now on the market it is difficult to determine the proper capacity to use beforehand. The following table will be found sufficiently accurate for the average coil.

Table of capacities required for condenser when spark coils are used:

Length of Sparks in inches	Capacity in Microfarads.
¼	.001
½	.002
1	.004
2	.008
3	.012
4	.016

These values are approximate and will vary according to the coil used.

A more satisfactory method when spark coils are employed is to use a variable step by step condenser in which the capacity of each plate is known. This capacity may be found from a formula which will be given a little later.

It will be obvious from the foregoing formula that when a low potential is used, the capacity must be relatively large, and that if a high potential is used the capacity will be correspondingly small. In practice the transformer used generally has a potential of from 15,000 volts for ¼ and ½ K. W. to perhaps 30,000 or more for the larger sizes. There is no material gain in the amount of dielectric material whether or not a high or low voltage is employed since a corresponding increase in thickness for the dielectric is necessary to withstand the higher voltage without a breakdown. An increase in frequency then is the only factor which materially affects the size of a given condenser.

In estimating the voltage to substitute in the formula, it is customary to allow 15,000 volts to the centimeter of spark length, one inch being 2.54 centimeters, since this is a fair value for a heated and ionized spark gap.

Now, with the condenser and transformer decided upon, the inductance for the primary or condenser circuit is the next item to work out. As will presently be shown, the wave length of the condenser circuit is varied by the amount of capacity and inductance in the circuit, and since the capacity is preferably a fixed value (wireless apparatus manufacturers generally supply a fixed condenser of the proper dimensions to begin with), the amount of inductance used will decide the wave length, in most cases. Before proceeding further, the method of determining the wave length must be understood. This involves only simple mathematics and can easily be mastered by a careful reading, together with the working of a few problems, if it is not already familiar to the readers.

CALCULATION OF WAVE LENGTH.

Wave length is expressed in the metric system as a certain number of meters long. Now, feet can easily be changed into meters by dividing the num-

ber of feet by 3.281 (one meter being 39.37 inches). If we had a universal system of measurement this constant translation would be saved.

The formula for wave length is:

Wave length $(\lambda)=v\times 2\pi\sqrt{LC}$, (λ) being a symbol for wave length, v the velocity of light in meters or 3×100000000 meters in one second, L the inductance in henrys, and C the capacity in farads. $\pi=3.1416$.

Wave length$=300,000,000\times 2\times 3.1416\sqrt{L\times C}=1,884,960,000$ times the square root of the product of L and C, or 1,884.96 times the square root of the product of L and C, expresed in microhenrys and microfarads, respectively. (.000001 farad being one microfarad, and .000001 henry being one microhenry.)

Now for a given wave length, the product of L and C will be a *constant quantity* so that if the capacity C is large, L will be correspondingly small, or if the inductance L is large, C will be small. The quantity (LC) varies as the square of the wave length so that if the wave length is to be doubled (LC) must be four times as great, and so on.

It will be noted from the formula that there are three items to be filled in by numerical quantities. If any two are known, the value for the other one may be readily found. Thus, if a wave length of 200 meters is desired with the use of the .0105 microfarad condenser already calculated for the ¼ K. W. set taken as an illustration, the necessary inductance can readily be found. Or if both the inductance and capacity are known, the wave length is readily determined. In order to still further simplify the formula so that it will not be necessary to extract the square root of (LC) it may be expressed,

$$\left[\frac{\text{Wave length}}{1,884,960,000}\right]^2=LxC \text{ (expressed in}$$

henrys and farads respectively. It might be well to jot down or memorize this formula as it is used repeatedly.

Using this formula for the case at hand, and expressing L and C directly in microhenrys and microfarads respectively,

$$\left[\frac{200}{1,884.96}\right]^2=Lx.0105.$$

$(.1061)^2=Lx.0105$.

$.011257=Lx.0105$ for the case at hand, that is,

$$L=\frac{.011257}{C}=\frac{.011257}{.0105}=1.072 \text{ microhenrys}$$

approximately, that is, to obtain a wave length of 200 meters when the inductance is an unknown quantity and the capacity is .0105 microfarads, the formula gives 1.072 microhenrys as the proper amount of inductance.

When the wave length is fixed at 200 meters, the formula may be greatly simplified to $LxC=.011257$.

This article will be concluded in the next issue, giving directions for calculating transmitting condenser, inductance, standard helix and spark gap.—Editorial note.

Directory of Wireless Clubs

This directory of amateur wireless clubs and associations will be published each month. When a new club is formed the names of the officers, also the street address of the secretary, should be forwarded to us at once. Any changes that should be made in the directory, when designated by an official of a club, will be made in the next issue after receipt of such advice.

Aerogram Club.—J. Stedman, President; A. Hayward Carr, Chairman Board of Directors; Albert S. Hayward, Treasurer; Donald P. Thurston, Secretary; Walter B. Clarke, 17 May St., Newport, R. I., Corresponding Secretary.

Aerograph Club of Richmond, Ind.—H. J. Trueblood, President; Richard Gatzek, Vice President; James Pardieck, 320 South 8th St., Richmond, Ind., Secretary.

Aero Wireless Club.—A. Garland, President; W. Ladley, Vice President; D. Beard, Napa, Calif., Secretary and Treasurer.

Allegheny County (Pa.) Wireless Association.—Arthur O. Davis, President; Theodore D. Richards, Vice President; James Seaman, Leetsdale, Pa., Secretary and Treasurer.

Alpha Wireless Association.—L. L. Martin, President; F. A. Schaeffer, Vice President; G. F. Girton, Box 57, Valparaiso, Ind., Secretary and Treasurer.

Amateur Wireless Association of Schenectady, N. Y.—D. F. Crawford, President; L. Beebe, Vice President; C. Wright, Treasurer; L. S. Uphoff, 122 Ave. "B," Schenectady, N. Y., Secretary.

Amateur Wireless Club of Geneva (N. Y.).—H. B. Graves, Jr., President; C. Hartman, Vice President; L. Reid, Treasurer; Benj. Merry, 148 William St., Geneva, N. Y., Secretary.

Arkansas Wireless Association.—G. A. Rauch, President; Edward Vaughn, 2622 State St., Little Rock Ark., Secretary and Treasurer.

Berkshire Wireless Club.—Warren A. Ford, President; William Yarkee, Vice President; Charles Hodecker, Treasurer; Jas. H. Ferguson, 18 Dean St., Adams, Mass., Secretary.

Canadian Central Wireless Club.—Alexander Polson, President; Stuart Scorer, Vice President; Benj. Lazarus, P. O. Box 1115, Winnipeg, Manitoba, Can., Secretary and Treasurer.

Cardinal Wireless Club.—K. Walthers, President; F. Dannenfelser, Vice President; Miss A. Peterson, South Division High School, Milwaukee, Wis., Secretary.

Chester Hill Wireless Club.—Waller Morgan, President; Richard D. Zucker, 46 Clinton Place, Mt. Vernon, N. Y., Secretary and Treasurer.

Chicago Wireless Association.—John Walters, Jr., President; E. J. Stien, Vice President; C. Stone, Treasurer; F. D. Northland, Secretary; R. P. Bradley, 4419 South Wabash Ave., Chicago, Ill., Corresponding Secretary.

Colorado Wireless Association.—William Cawley, President; Thomas Ekren, Vice President; W. F. Lapham, 1545 Milwaukee St., Denver, Colo., Secretary-Treasurer.

Custer Wireless Club.—Franklin Webber, President; Fred Cross, Vice President; Oakley Ashton, Treasurer; Walter Maynes, 438 Custer Ave., Los Angeles, Cal., Secretary.

De Kalb Radio-Transmission Association.—Bruce Lundberg, President; Walter Bergendorf, Vice-President; De Estin Snow, Treasurer; Bayard Clark, 205 Augusta Ave., De Kalb, Ill., Secretary.

Fargo Wireless Association.—Kenneth Hance, President; John Bathrick, Vice President; Earl C. Reineke, 518 9th St., Fargo, N. D., Secretary.

Forest Park School Wireless Club.—W. S. Robinson, Jr., President; William Crawford, R. F. D. No. 1, Springfield, Mass., Secretary.

Frontier Wireless Club.—Chas. B. Coxhead, President; John D. Camp, Vice President; Franklin J. Kidd, Jr., Treasurer; Herbert M. Graves, 458 Potomac Ave., Buffalo, N. Y., Secretary.

Geneva Wireless Club.—Charles B. Hartman, President; Charles Smith, Vice-President; Benjamin Merry, Treasurer; Henry B. Graves, Jr., 448 Castle St., Geneva, N. Y., Secretary.

Gramercy Wireless Club.—James Platt, President; John Gebhard, Vice President; John Diehl, Treasurer; John Jordan, 219 East 23d St., New York, N. Y., Secretary.

Greenfield Wireless Association.—Edward M. Wolfe, President and Corresponding Secretary, 4125 Haldane St., Pittsburgh, Pa.

Hannibal (Mo.) Amateur Wireless Club.—Charles A. Cruickshank, President; J. C. Rowland, Vice President; William Youse, Treasurer; G. G. Owens, 1306 Hill St., Hannibal, Mo., Secretary.

Haverhill (Mass.) Wireless Association—Riedel G. Sprague, President; Charles Farrington, Vice President; Leon R. Westbrook, Haverhill, Mass., Secretary and Treasurer.

Hobart Wireless Association.—Asa Bullock, President; Charles Clifford, Hobart, Ind., Secretary.

Independence Wireless Association.—Boyce Miller, President; Ralph Elliott, Secretary; Joseph Mahan, 214 South Sixth St., Independence, Kan., Vice President.

Independent Wireless Transmission Co.—Harlan A. Eveleth, 72 Gray St., Arlington, Mass., Secretary.

Jonesville Wireless Association.—Frederic Wetmore, President; Webb Virmylla, Vice President; Richard Hawkins, Treasurer; Merritt Green, Lock Box 82, Jonesville, Mich., Secretary.

Lake View Wireless Club.—E. M. Fickett, President; R. Ludwig, Treasurer; R. F. Becker, 1439 Winona Ave., Chicago, Ill., Secretary.

Long Beach Radio Research Club.—Bernard Williams, 555 E. Seaside Bvd., Long Beach, Calif., Secretary.

Manchester, (N. H.) Radio Club.—Homer B. Lincoln, President; Clarence Campbell, Vice President; Elmer Cutts, Treasurer; Earle Freeman, 759 Pine St., Manchester, N. H., Secretary.

New Haven Wireless Association.—Roy E. Wilmot, President; Arthur P. Seeley, Vice President; Russell O'Connor, 27 Vernon St., New Haven, Conn., Secretary and Treasurer.

Northwestern Wireless Association of Chicago—Rolf Rolfson, President; H. Kunde, Treasurer; Edw. G. Egloff, 2729 Noble Ave., Chicago, Ill., Recording Secretary.

Oakland Wireless Club.—H. Montag, President; W. L. Walker, Treasurer; W. R. Sibbert, 916 Chester St., Oakland, Calif., Secretary.

Oklahoma State Wireless Association.—T. E. Reid, President; G. O. Sutton, Vice-President; Ralph Jones, Box 1448, Muskogee, Okla., Secretary and Treasurer.

Oregon State Wireless Association.—Charles Austin, President; Joyce Kelly, Recording Secretary; Edward Murray, Sergeant-at-Arms; Clarence Bischoff, Lents, Ore., Treasurer and Corresponding Secretary.

Peterboro Wireless Club.—G. B. Powell, President; C. V. Miller, Vice President; E. W. Oke, 263 Engleburn Ave., Peterboro, Ontario, Can., Secretary and Treasurer.

Plaza Wireless Club.—Paul Elliott, President; Myron Hanover, 156 E. 66th St., New York, N. Y., Secretary and Treasurer.

Pueblo Wireless Club.—L. R. Finke, President; B. C. Howe, Treasurer; K. G. Hermann, 100 Board of Trade, Pueblo, Colo., Secretary.

Rockland County Radio Wireless Association.—M. V. Bryant, President; H. I. Sprott, Treasurer; P. Haeselbarth, Nyak, N. Y., Secretary.

Roslindale (Mass.) Wireless Association.—O. Gilus, President; C. F. McKay, Treasurer; Fred C. Fruth, 962 South St., Roslindale, Mass., Secretary.

Sacramento Wireless Signal Club.—E. Rackliff, President; J. Murray, Vice President; G. Banvard, Treasurer; W. E. Totten, 1524 "M" St., Sacramento, Calif., Secretary.

Santa Cruz Wireless Association.—Orville Johnson, President; Harold E. Sentor, 184 Walnut Ave., Santa Cruz, Calif., Secretary and Treasurer.

Southeastern Indiana Wireless Association—R. F. Vaught, President; D. C. Cox, Vice President and Treasurer; H. Hitz, Fairmont, Madison, Ind., Corresponding Secretary.

Southern Wireless Association.—B. Oppenheim, President; P. Gernsbacher, 1435 Henry Clay Ave., New Orleans, La., Secretary and Treasurer.

Springfield (Mass.) Wireless Association.—A. C. Gravel, President; C. K. Seely, Vice President and Treasurer; D. W. Martenson, Secretary; Club Rooms, 323 King St., Springfield, Mass.

Spring Hill Amateur Wireless Association.—R. D. Thiery, President; H. R. Hood, 2nd, 2 Benton Road, Somerville, Mass., Secretary and Treasurer.

St. Paul Wireless Club.—Thos. Taylor, President; L. R. Moore, Vice President; E. C. Estes, Treasurer; R. H. Milton, 217 Dayton Ave., St. Paul, Minn., Secretary.

Tri-State Wireless Association.—C. B. DeLa-Hunt, President; O. F. Lyons, Vice President; T. J. M. Daly, Treasurer; C. J. Cowan, Memphis, Tenn., Secretary.

Waterbury Wireless Association.—Arthur E. Hapeman, President; Walter Lowell, Treasurer; H. M. Rogers, Jr., 65 Elizabeth St., Waterbury, Conn., Secretary.

Wireless Association of British Columbia.—Clifford C. Watson, President; J. Arnott, Vice President; E. Kelly, Treasurer; H. J. Bothel, 300 Fourteenth Ave. E., Vancouver, B. C., Corresponding Secretary.

Wireless Association of Canada.—W. Fowler, President; E. G. Lunn, Vice President; W. C. Schuur, Secretary and Treasurer.

Wireless Association of Fort Wayne.—Adolph Rose, 1326 E. Wayne St., Fort Wayne, Ind., President and Secretary.

Wireless Association of Montana.—Roy Tysel, President; Elliot Gillie, Vice President; Harold Satter, 309 South Ohio St., Butte, Mont., Secretary.

Wireless Association of Savannah.—P. C. Bangs, President; A. A. Funk, Vice President; H. Jenkins, Treasurer; L. H. Cole, Cor. Liberty and Price Sts., Savannah, Ga., Secretary.

Wireless Club of Baltimore.—Harry Richards, President; William Fules, Vice President; Curtis Garret, Treasurer; Winters Jones, 728 North Monroe St. Baltimore, Md., Secretary.

Wireless Club of the Shortridge High School.—Robert C. Schimmel, 2220 N. Penn St., Indianapolis, Ind., President; George R. Popp, Vice President; Bayard Brill, Treasurer; Oliver Hamilton, Secretary.

Zanesville Wireless Association.—Charles S. Shryock, President; Rudolph C. Kamphausen, 105 South Seventh St., Zanesville, Ohio, Secretary-Treasurer.

For Practical Electrical Workers

Wiring in Damp Places

By C. B. DAVIS

In wiring in damp places such as in dye-houses, stables and breweries, wires should be rubber insulated, and separated by knobs at least one inch from the surface wired over. Solid knobs are preferable to split ones, because there is more liability of current leakage to the screw of a split knob. They should be separated by at least 2½ inches for voltages up to 300 and four inches for voltages up to 600. Greater separations are preferable. Conductors on side walls should be protected preferably with well painted wooden boxing, but conduit can be used. Moulding is not permitted in damp locations. Sockets and other fittings in such places should be designed to withstand moisture.

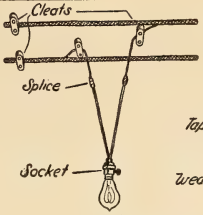
Where conductors cross damp pipes they should be carried over rather than under, so that drippings will not strike the wires. Porcelain tubes, securely taped to the conductors, should be placed on the conductors over the point where they cross.

Sockets for damp places should be of porcelain or hard rubber, or composition weatherproof, or, as they are sometimes called, "waterproof," Fig. 1. Unless made up on fixtures they should be hung by separate stranded, rubber insulated wires, not smaller than No. 14 B. & S. gauge, which should preferably be twisted together when the pendant is over three feet long. The leads furnished in weatherproof sockets are six or eight inches long, but longer ones can be supplied on special order. The socket leads should be soldered direct to the circuit wired but supported independently of them. Fig. 2 shows a short drop and Fig. 3 a long one; both figures illustrate the method of using cleats to remove the stress from the line conductors. Waterproof sockets are always keyless. Porcelain sockets are easily broken; hence, although their use is not formally approved by the underwriters, brass-shell sockets thoroughly taped and coated with waterproof paint are sometimes used. Where not liable to be broken, porcelain or composition sockets are the best.

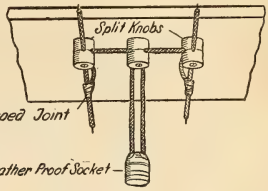
Receptacles for damp places are shown in Fig. 4. They are especially designed to withstand moisture, but should always be supported on porcelain knobs. The rubber insulated leads extend six or eight inches from the body. The leads should be soldered directly to the line wires and the joint well taped and compounded.

Wiring troughs are sometimes used in damp places, Fig. 5. The troughs protect the conductors from drippings, but not from water that condenses on them out of the atmosphere. In assembling wiring troughs, abutting edges should be coated with tar or with thick waterproof paint. Screws smeared with paint should be used to hold the pieces together and the screw heads should be painted. A wiring trough in addition to keeping drippings from the conductors, constitutes a mechanical protection for the conductors. The wiring trough serves the same purpose as a running board in this respect.

Fig. 1



Two Cleat Support



Split Knob Support

Fig. 2

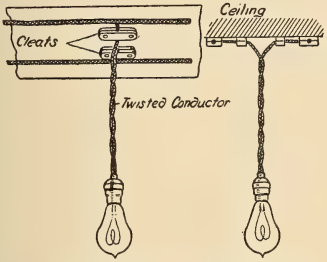


Fig. 3

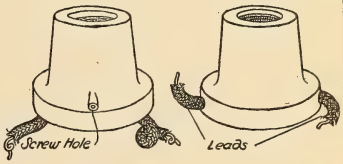


Fig. 4

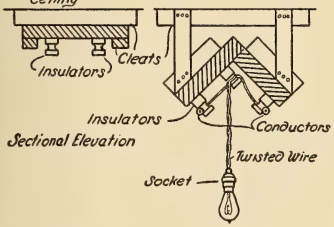


Fig. 5

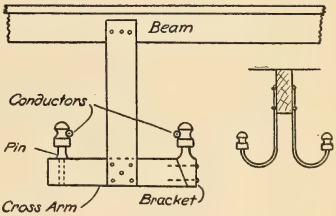


Fig. 6

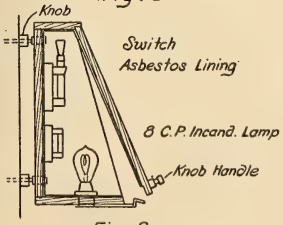


Fig. 8

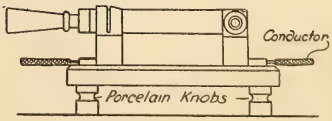


Fig. 7

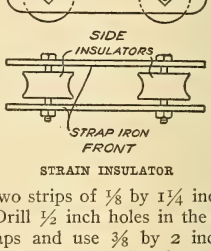
Porcelain or glass, petticoat insulators probably form the best support for wiring in damp places. These are the same insulators that are used on out-of-door pole lines. There is apt to be considerable electrical leakage in damp places with ordinary knobs and cleats, and the long creepage distance provided by petticoat insulators constitutes good protection against this. The insulators are supported on thoroughly painted wooden pins or brackets, which are held by small cross arms or on metal brackets, Fig. 6. In no case should the insulator be mounted up-side-down. Glass or porcelain knobs, mounted on a small cross-arm, are sometimes used instead of insulators, but are not as good from an insulation standpoint. The advantage of mounting them on the arm is that an ample separation from the surface wired over is thus provided. The cross-arm support should be thoroughly painted with a waterproof paint or tar.

Joints and splices in damp places must be soldered with great care and should be thoroughly taped. A thorough painting of the tape wrapping, with a waterproof compound, asphaltum or tar, will protect against the entrance of moisture. Splices should be avoided in damp places, but where necessary, they should be located at some distance from a point of support, because the insulation resistance of the insulation around a splice is less than that of an unimpaired equal length of wire.

Switches and fuses for wiring in damp locations should, if possible, be located outside of the damp room and in a dry place. Where it is impossible to locate them outside they should be mounted within a box the inside of which can be kept dry, or on porcelain knobs, Fig. 7. Cabinets thoroughly treated with waterproof compound are preferable to metal ones. A switch-and-fuse cabinet similar to that of Fig. 8 can be made of ⅞ inch stock. It is lined with well painted asbestos board and mounted away from the damp wall on porcelain knobs.

Strain Insulators

The illustration shows an easily made insulator for use on antenna and guy wires of an amateur wireless station. Place two No. 15 porcelain knobs be-

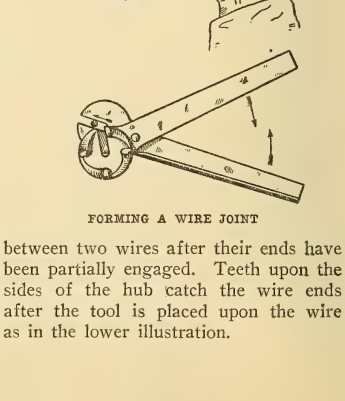


STRAIN INSULATOR

tween two strips of ⅛ by 1¼ inch strap iron. Drill ½ inch holes in the ends of the straps and use ⅜ by 2 inch bolts through these to hold the porcelain knobs.

Tool for Forming Wire Joints

The accompanying illustration presents the idea, embodied in a patent issued to Abraham B. Probasco, Turtle Creek, Ohio, of a tool for completing the joint

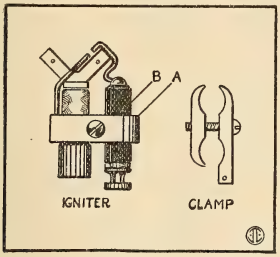


FORMING A WIRE JOINT

between two wires after their ends have been partially engaged. Teeth upon the sides of the hub catch the wire ends after the tool is placed upon the wire as in the lower illustration.

Lighter for Auto Gas Headlights

A device for lighting gas headlights on an automobile is shown in the accompanying illustration. A clamp (A) holds a hard rubber insulator (B) to the burner. A gap is formed by leading a copper wire from the clamp, and a



LIGHTER FOR GAS HEADLIGHTS

wire from the rod through (B), to a point over a hole in the burner. The gap is about 1/16 inch. Wires from a spark plug circuit are connected to each burner, the circuit being under control from a switch on the dashboard. By turning on the gas and closing the switch for an instant the headlights are lighted. —Jesse Jay.

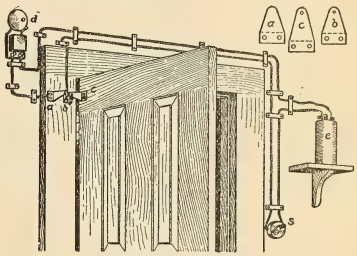
Capacity of a Lifting Magnet

Heretofore the practice of handling furnace pig iron with electro-magnets has been limited by the quantity that could be lifted under the ordinary plan of picking the iron from the ground. When the pigs lie flat, only a relatively small number adhere to the magnet. Now, however, at the Maryland Steel Works, outside of Baltimore, they are testing the value of their magnets on stocks of pigs which stand in a bunch vertically erect.

Thus a greater number of pieces on end make direct contact with the magnet pole pieces and a corresponding increase in the lifting power of the magnet follows. A magnet formerly able only to heave 1,000 pounds heavenwards, now easily lifts 2,000 pounds of pigs "standing on their tiptoes" as the workmen say.

Open Door Alarm

A good open door alarm may be made as follows: Provide two pieces of stiff brass (a) and (c) cut in the shape shown and bent at a right angle on the dotted line. Provide also a piece of spring brass (b) cut as indicated and



OPEN DOOR ALARM

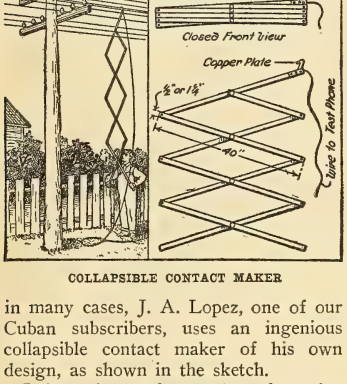
bent at a right angle on the dotted line. Referring to the illustration, set (a) and (b) on the casing, bending the tongues on each so they touch. Set (c) upon the door. Connect (b) and (c) by a chain or wire of such length that when the door is closed (b) is pulled away from (a), breaking the tip contact. The rest of the wiring may be done as shown, placing a switch at (s) to open the circuit when it is not desired to have the alarm operate.—Ole B. Ritchey.

Show Case Signs

Among the latest store devices are small illuminated signs having ground glass slidable fronts, on which is printed information regarding the special articles for sale. The fronts may be replaced with others for the sale of different goods. An eight candlepower lamp is sufficient to give the necessary effect, and the design is such that they add to the attraction of the show cases on which they are usually placed.

Collapsible Contact Maker

In making tests on telegraph, telephone and trolley wires contact must be made at times with a wire that cannot be conveniently reached. To do this and to avoid the necessity of climbing poles



COLLAPSIBLE CONTACT MAKER

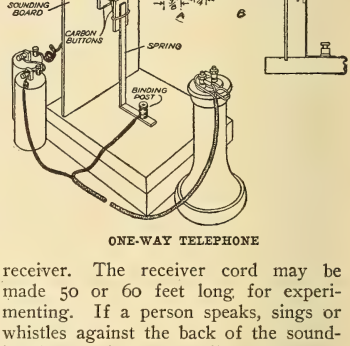
in many cases, J. A. Lopez, one of our Cuban subscribers, uses an ingenious collapsible contact maker of his own design, as shown in the sketch.

It is made up of a number of wooden bars riveted together as shown. By closing the two end ones, as if closing the handles of a pair of shears, the collapsible frame is projected up a distance corresponding to the number of bars used. On the upper end is a copper hook carrying the test wire. This is hooked over the line.

To Make a Simple One-Way Telephone

Out of white pine make a base 4 by 5 by 1 inch thick and bevel the edges. Cut a groove in the top at one end, as shown, 3½ by ⅛ by ⅛ inch. Make a sounding board of white pine ⅛ by 3½ by 5½ inches long and glue it into the groove so that it stands perpendicular to the base. Shellac the whole thing.

Take the carbon from a wornout dry cell and make two pieces, shaping as indicated by (A) and (B). Drill a 3/16 inch hole through the flat part of (A) and a 3/16 inch hole ¾ of an inch from the top of the sounding board. Fasten (A) to the board by means of a battery binding post. Then take (B) and bind it by means of a copper wire to a thin brass spring 5½ inches long and ¼ inch wide, bent as shown. Now adjust the two carbon blocks so that the two points touch lightly. Connect up as indicated, using two dry cells and a 75 ohm



ONE-WAY TELEPHONE

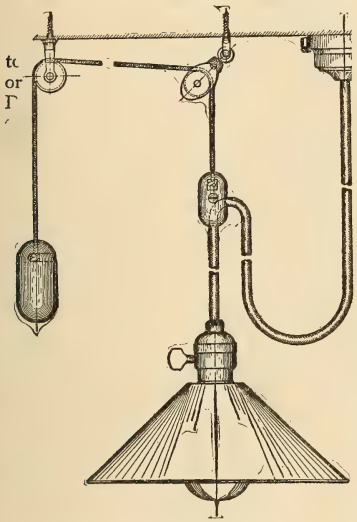
receiver. The receiver cord may be made 50 or 60 feet long for experimenting. If a person speaks, sings or whistles against the back of the sounding board, the sound will be distinctly heard in the receiver, even though the receiver be 50 feet away. The ticking of a watch laid on the base of the device can be plainly heard. A person walking across the floor disturbs the contacts sufficiently to be heard.

Supporting Open Wiring in Concrete Buildings

A method of supporting open wiring in concrete buildings is here shown. A round groove of ⅜ inch radius is cast in the faces of the beams, by having ¾ inch half round moulding nailed in the forms. Wrought iron yokes are bent to fit the grooves as shown, and ½ inch bolts clamp them in position. Although moulding is shown supported in the illustration, wooden blocks can be bolted

Drop Light Counter-Balance

The Simplex counter-balance here illustrated serves to regulate the height of an incandescent with little trouble. A two part insulating clamp secures the conductor and is held by a suspending



DROP LIGHT COUNTER-BALANCE

cord which passes over a swivel and a fixed pulley on the ceiling, then down to the weight. The lamp drops straight from the clamp as it would from any rosette.

Keeping the Motorman Warm

An interurban car company, realizing the possibility of accidents which might occur if the motorman was uncomfortably cold, which would naturally result in his paying more attention to keeping himself warm than to the correct operation of the train, uses a portable electric heater of sufficient size to keep the cab warm at all temperatures.

Receptacles connected to the current supply are placed in both ends of the car, so that the motorman can use the heater, no matter which end of the car is being used for the front.

Conveniences in House Wiring

To wire a house so that each room is provided with lights is not all there is to a "good job" of wiring. There are numerous little things that count for convenience and comfort that should not be overlooked in such an installation. Some of these conveniences which add little to the cost are here noted.

Locate a wall switch or two just inside the front door so that it can be reached at once on entering. One of these switches should turn on the light in the hall, and the other, a three-way, should control the porch light. The other three-way switch for the porch light may be located outside beside the doorway to turn this light on or off when entering or leaving the house.

Clothes closets are dark places. A low candlepower lamp should be installed in each at the ceiling and controlled by automatic door switches which turn the light on when the closet door is opened and turn it off when the door is closed.

Place the switch that controls the cellar lights at the head of the stairs so that the cellar lights may be used to illuminate the stairway when entering the cellar. Beside this switch may be placed a small red lamp to remind that the lights are to be turned off on coming upstairs.

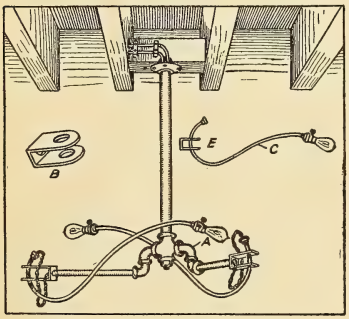
Baseboard or wall receptacles for attachment plugs for the piano lamp, the lamp on the table at the side of the room and for the electric luminous radiator should not be foregotten.

Economy and comfort require a turn-down or Hylo lamp in bathrooms and halls and also for the bedroom in case of sickness.

In the dining room and kitchen, receptacles for operating an electric toaster and a coffee percolator in either room should not be overlooked, while a special circuit for the electric pressing iron should be provided.

Adjustable Work Bench Fixture

To make a two-light bench fixture, cut and thread a piece of 1¼-inch pipe about 2½ feet shorter than the distance between the ceiling and the top of the work bench. Connect a 1¼ by ½ inch cross at one end and from the ½ inch openings at



ADJUSTABLE WORK BENCH FIXTURE

each side insert two els (male and female) loosely connected together, as shown at (A).

Next, attach two-foot lengths of ½ inch pipe and on the free ends fasten, with lock nuts, U-shaped pieces of strap iron, as shown at (B), which have had holes slightly larger than the outside diameter of ¼ inch pipe bored near the ends and opposite each other.

Pieces of ¼ inch pipe 3½ feet long are bent in the curve shown at (C), and after being inserted in the U-shaped pieces have couplings attached to the upper ends. Two lengths of No. 14 insulated wire may be used in the large pipe to which at the T is soldered and taped double twisted lighting cord, which is left long enough to pull into the fixture arms, allowing about twelve inches of slack cord for adjustment at (D).

After wiring and attaching lamp sockets, insert a 1¼ inch plug at the bottom of the vertical pipe and secure the pipe to a threaded flange at the ceiling, allowing an opening for attaching lighting circuit wires. Have fittings loose enough at (A) to allow arms to swing. Conduit and condulets may be used in place of gas pipe if desired. W. R. Reynolds.

A Trade Winning Shoe Brush

Using the power applied to his electrical shoe repair machinery, a tradesman in a Western city has placed an electrically operated shoe brush in front of his place of business, which brings him profits in the shape of new and friendly customers. A belt transmission and a shaft that projects through the front wall of his shop were all the additions he had

SHOE BRUSH FOR PASSERS-BY

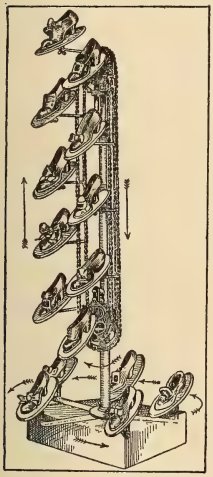
to make to his outfit, and as the machinery is in use all the time, there is no additional cost for power. The circular brush is revolving all the time from the end of the shaft, and is placed at a convenient height for shoe brushing—just high enough from the pavement for the passer-by to bring his footwear in contact with it and remove the dust. A sign calls attention to it and states that its use is free. It is a trade winner.

Electricity the Silent Salesman

Some helpful hints on the use of electric current in getting up show window displays. The following schemes have all been used with remarkable success.

Miniature Elevator Displays Shoes

The device here shown, manufactured by The Newman Manufacturing Company, is designed to be placed at the center of a window display. Operating like an elevator and furnished power by a small electric motor it brings to view one after another the shoes placed upon it. The device is finished in oxidized copper, and is also built to exhibit jewelry and other goods.

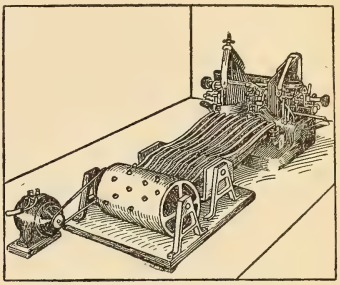


DISPLAYING SHOES ON AN ELEVATOR

Testing a Typewriter in a Window

A large typewriter manufacturing firm which prides itself upon the fact that every typewriter sent out is first put through severe tests to find any weaknesses shows a testing machine operating a typewriter in the window of its offices.

The device consists of a cylinder upon which are projecting teeth. When this cylinder is turned these teeth, one after another, strike the keys of a sort of lever keyboard. Each lever operated in turn a key upon the typewriter. The machine

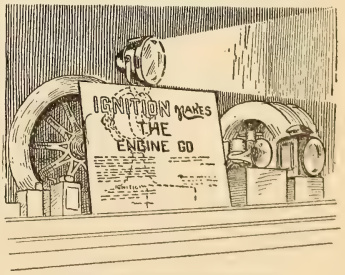


TYPEWRITER UNDER TEST

tests the speed capacity of each typewriter and at the same time the wearing parts are brought down to their proper bearings. Any flaws are almost sure to be detected, as the testing device can be speeded up to a point faster than fingers can move or eyes can see. The equipment is run by electric power, and is a strong advertisement of the durability of the machine.

Moving Headlight as Window Attraction

Remove the blades and guard from an oscillating fan motor. Fasten an electric automobile headlight by means of two brass uprights to the case of



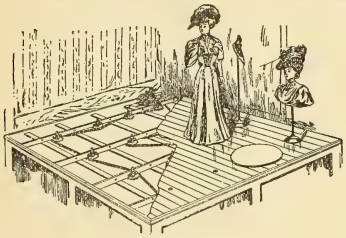
MOVING HEADLIGHT ATTRACTION

the fan at (A) with the same screws that held the guard. When the motor is started and the lamp lighted, the latter will swing to and fro catching the eyes of passers-by.

To hide the motor, place a neat and attractive sign as shown.

Invisible Multiple Rotary for Windows

The illustration shows how a number of stands, forms or round platforms may be made to revolve, some in one direction, some in another. Upon the floor of the window is built a light, four inch high platform within which are sprockets



ROTARY WINDOW DISPLAY

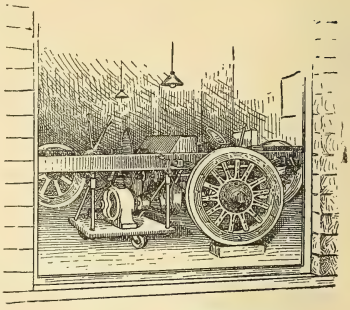
and bicycle chain. A small motor furnishes the motive power and with this concealed the entire mechanism which imparts motion to the window display is invisible.

The device is a regularly manufactured article and is known as the Newman multiple rotary.

Demonstrating Gasoline Auto Trucks

Insurance companies charge a higher rate for buildings storing gasoline automobiles than when electrics only are housed because of the presence of gasoline.

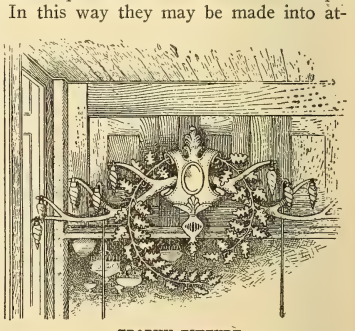
To get rid of this extra premium on his truck display rooms, an agent obtained a platform about four feet square and mounted it on wheels. He placed thereon a small motor starting-box and switch with the necessary length of portable cable. When it was necessary to show the operation of truck engines, he rolled the platform under the car and connected the motor to the engine flywheel with a small belt.



AUTO TRUCK DEMONSTRATION

Trophy Fixture

Up to a very short time ago, trophies of the chase were used for decorative purposes alone; but with the advent of artistic electroliers they have been made useful as well as ornamental by fitting them up for fixtures of miniature lamps. In this way they may be made into attractive window displays for jewelry stores and similar places of business.



TROPHY FIXTURE

The illustration shows one of such being used for a combined hall light and ornament.

The Magnet

By GEO. FREDERIC STRATTON

According to Chinese lore, the magnet with its real and imaginary mystical properties has puzzled and served the world for 45 centuries; a legend coming down from those past ages that a certain emperor of the country possessed a wheel marked with the four cardinal points, which he used for directing the operations of his army during foggy weather.

It was not, however, until the approach of the Christian era that any authentic records were made of this wonderful, natural magnetic force; and these are mingled with strange and imaginative stories. Strabo, the Greek philosopher, and evidently the Jules Verne of his day, wrote an account of a chimerical correspondence between two friends by the help of a certain lodestone which had such virtue in it that, if it touched two separate needles, when one of those needles so touched began to move, the other—though at never so great a distance—moved at the same time in the same manner.

He tells us that these friends, being each of them possessed of one of these needles, made a kind of dial plate, inscribing it with the letters of the alphabet. Then they fixed one of the needles on each of these plates in such a manner that it could move around without impediment, so as to touch any of the four and twenty letters. Upon their separating from one another into distant countries, they agreed to withdraw themselves, punctually, into their closets at a certain hour of the day and converse with one another across a whole continent. And by means of this invention they did afterwards convey their thoughts to each other in an instant, over cities, mountains, seas or deserts.

This yarn was written 31 B. C. and is worthy of more than passing notice as being strangely prophetic of the recent wireless telegraph inventions.

Lucretius (55 B. C.) in a poetical dissertation on the lodestone, gives a clear description of its actions.

"Oft from the magnet, too, the steel recedes,
Repelled by turns and reattracted close."

In the Fifth Century record is made of its general use by Chinese mariners and, in the following 500 years it must have been extensively adopted by navigators in European waters, for Abbot Nickham (1157 A. D.) writes:

"Among other stores of a shippe there must be a needle hung upon a thread, which will vibrate, oscillate and turn until the point looks to the north, and the sailors will thus know how to direct their course when the pole star is concealed through the troublous state of the atmosphere."

And, in a quaint poem written by Guyot de Provins in 1208, the compass is thus described:

"An ugly stone and brown,
To which iron joins itself willingly,
They have. They attend to where it points
After they have applied a needle to it.
And they lay the latter on a straw
And put it simply in the water
Where the straw makes it float.
Then the point turns direct
To the star with such certainty
That no man will ever doubt it,
Nor will it ever go wrong."

This straw supported needle was superseded in 1269 by the invention of Petrius Peregrinus, an officer of the engineering corps of the French army. He placed the needle upon a pivot and surrounded it with a graduated circle showing all the points of the compass.

Peregrinus was a very talented man. He wrote the first practical disquisition on the lodestone and its applications,

and he invented a clever and ingenious magnetic motor, undoubtedly the first device of the kind ever conceived in the brain of man.

No further improvement of the mariner's compass, or advancement in the knowledge of its correct use, is recorded until we come to Dr. Gilbert's masterly and exhaustive ten volume treatise on the subject—"De Magnete"—published in 1600.

Dr. Gilbert was physician to Queen Elizabeth, and was accorded a prolonged audience in order to read portions of his work to her Majesty and, although the petulant and self willed queen exclaimed at the close of the reading: "Ods rot! but I know not what it all means!" she did not fail to reward and honor the eminent lecturer.

The doctor deserved more appreciative understanding of his efforts for, in his introduction, he says that he "desired not to veil things in pedantic terminology." And he succeeded admirably; his work being characterized as one of the clearest and most lucid philosophical treatises of the Middle Ages.

Poets have ever delighted in using the lodestone and the needle as emblems of constancy, affection and love; but the needle is, alas! like love, easily and frequently deviated, and blind faith in its constancy has caused untold disaster and misery.

In the early centuries of its use, the shipwrecks and loss of life due to errors and idiosyncrasies of the compass must have been appalling, but although these variations were observed no effort was made to investigate the causes, they being attributed to evil spirits, sorcery and witchcraft. Even today the ship compass, with its perfect detail of construction, requires unceasing watchfulness and adjustment.

One of Captain Cook's men, Wales—an astronomer—was the first to look, scientifically, for the causes of so many disastrous errors, and he soon found them in the ship, herself. Anchors, chain cables and iron of any description were first observed to have an effect upon the susceptible needle, diverting it from its duty. The British naval authorities took immediate and active steps to place their war vessels in a more trustworthy condition.

But in those early days scientific truths travelled slowly, and it was many years before shipowners and shipmasters were thoroughly and universally imbued with the necessity of correcting and adjusting their compasses at frequent intervals. If it was necessary or convenient to coil a few fathoms of anchor-chain on the ship's quarter, or to stow a freight of hardware in the vicinity, no thought was given to the compass. The ship might go off her course several points and miss her port, or strike bottom; the skipper would damn everybody and everything except the true cause.

With the advent of polar expeditions another disturbing cause was discovered. It had always been supposed that the attraction for the needle was a gigantic deposit of lodestone at the north pole; but the explorer Kane, first determined that the north pole was by no means the magnetic pole. And later explorers and scientists have also discovered that there are two magnetic poles—one, N.N.W. of Hudson Bay; the other—far less in strength—in Siberia, the exact location of which is not, as yet, defined.

By this time shipbuilders had become thoroughly alive to the necessity for watchfulness of the compass. The instrument was carefully adjusted and corrected after all fittings and stores had been put on board, and a much greater reliability ensued. But with the advent of the iron ship new and mysterious actions of the needle commenced, and for awhile captains were kept at the top notch of anxiety over the correctness of their courses.

In order to understand this clearly it is necessary to call attention to the fact that if a bar of iron be laid pointing

north and south, and hammered, it will acquire more or less magnetic qualities, varying according to the number of blows struck, also according to the quality of the iron—whether hard or soft.

When an iron or steel ship is built, some plates or beams must, necessarily, be in a position bearing north and south, and will surely become magnetized from the shock and vibration of the riveting. Of course the proximity of large masses of magnetized iron to the compass has an enormous influence, but it can be and is corrected by compensating devices.

It has also been found that, when the vessel proceeds on her voyage, the buffeting of the waves and the vibration of the engines will induce further magnetism; and as the direction of the vessel is changed, so does the polarity become changed, and the compass is, accordingly, again bewildered and demoralized.

On a course running east and west—as from Liverpool to New York and return—this deviation of the compass is often as much as four degrees one way or the other, according as the ship is proceeding easterly or westerly. Devices are now employed in all ship's compasses by which they may be instantly corrected, but constant watchfulness and testing are still imperative.

Magnets are made by rubbing a piece of iron against lodestone—a mineral substance which is found over the entire globe. They can also be made, as before stated, by simply hammering any bar of steel or iron while it is pointed due north. If the metal is soft it will quickly lose its magnetism; if hard it becomes a permanent magnet.

The commercial manufacture of magnets, however, is now entirely by electricity. A coil of wire is provided, into which the iron or steel of any desired shape is inserted; a strong current of electricity is switched on, and in a moment the rod is magnetized. As in other processes, if the iron is hard a permanent magnet is the result; if the metal is soft its magnetism leaves it the moment the current is cut off. It is this peculiar property of soft iron, of instantly becoming magnetized and demagnetized, which makes the electro-magnet; and the electro-magnet is the inward soul—if so strong a metaphor may be used—of the great light and power generator of the present day. But that is another story.

Getting Ready for the Opportunity

Mr. George A. Damon, Dean of Throop Polytechnic Institute, Pasadena, Cal., desiring to secure information regarding the things the technical man must "stand for" in order to be successful in Southern California, addressed a list of questions to 70 of the most successful men engaged in technical occupations in that part of the state.

Three of the questions were:

"What do you think of a 'technical college education'?"

"What is the best way to get 'practical experience'?"

"If you were a young man starting all over again what would you do?"

Five answers to the first question from as many different men were:

"Good foundation for practical experience."

"A very necessary training for a man expecting to follow any line of engineering or control work."

"The higher positions of life especially in the present day and age, require technical training which is easier attained in college than elsewhere. Without such training a man usually comes to the sticking point beyond which an employer cannot advance him even though he has other splendid qualifications. He cannot see his problem completely and his vision is narrow. He is limited to his own experience and has no precedent to follow."

"The young man who has it, has an immense advantage over his competitors."

"College training gives to a workman the best tool in his chest but does not

guarantee success. Some of our pioneers can hew out a better timber with an axe than many an architect can make with a full set of modern tools."

Four answers to the second question were:

"There is only one way—don overalls, and go to it."

"Don't be afraid of getting hands and clothes dirty. Take any kind of a job where construction or operating work is actually done under regular working conditions."

"Association with construction work during vacations, and frequent changes in position during the period when salary is not the prime requisite for one's existence."

"Work at your profession for a year, if possible, between the preparatory school and college. Then work at it summers during college. If the work eliminates you, you are eliminated while still a student and will not become a graduate who made a failure."

Four replies to the last question were:

"Educate myself along the above lines (mining, hydraulic, electrical and mechanical engineering), besides acquiring a thorough knowledge of Spanish language, as I believe the great things accomplished in the next generation will be in the republics south of us."

"Work at my profession before and during the college course. If I could only get four years of a college course I would not take it all at one school, whether the diploma were lost thereby or not."

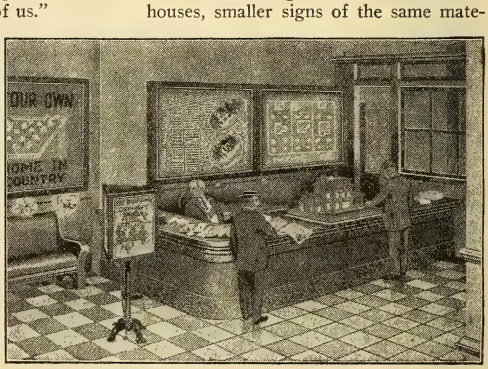
"Get the best technical college education available, work during the vacation periods for nothing, with the best man in my line, and when through with college work, would still work for practically nothing with large firms for several years, until feeling sure of myself. After this I would change my policies entirely and work for small firms, asking for high wages, forming my own opinions about the way my work should be done and following these out. Then I would carefully study myself and my work, see if I were really earning my money."

"Take more time for preparation and not begin to 'specialize' too soon."

Utilizing an Out-of-the-Way Corner for Effective Display Space

A real estate firm advertising the advantages of living in the western suburbs of Chicago occupies an out-of-the-way corner of the terminal station which is used by the trains running through this district, and has changed it into the most attractive office space in the depot by means of a few well disposed electric lamps. These are placed in trough-like enclosures and mounted so that they shine through six by ten inch ground glass signs on which are painted in natural colors the plats of ground for sale, the rivers and trees on the property and the firm's name in bold lettering.

For advertising the sale of individual houses, smaller signs of the same mate-



ATTRACTIVE SCHEME OF A REAL ESTATE OFFICE

rial with each house painted thereon are used, and mounted one above the other on the three sides of a slowly revolving triangular frame, also illuminated by electric lamps placed inside the triangle.

Dr. Eyde's Work in Electrical Production of Nitrogen

BY DR. LEONARD KEENE HIRSHBERG

Ten years ago Dr. Samuel Eyde of Christiania, Norway, was a struggling engineer, one of a family of electro-chemical engineers. Now he is rated one of the wealthiest men in Norway.

Dr. Eyde came to this country to deliver a lecture before the Eighth International Congress of Applied Chemistry. He has delivered the lecture only once in the past, before the Royal Society of London in 1909. He lectures only once in three years, and that fact, no doubt, adds to the great enthusiasm with which he is greeted by other chemists.

He tells the story of his life work with a series of lantern slides, and ends the showing with pictures of the four great nitrogen transforming plants now under his control, which have a capacity of 200,000 horsepower, and send out yearly 80,000 tons of nitrate of lime for use in fertilizers, 10,000 tons of nitrate of ammonia for use in explosives, 10,000 tons of nitrate of soda for use in coloring industries, and thousands of tons of other compounds of nitrogen. Having shown all this, including pictures of the complete chemical process from the harnessing of the air to the shipping of the finished products, Dr. Eyde, in optimistic mood, tells how Norway was prepared to furnish his chemical company with 150,000 additional horsepower almost free of charge, and how his country, independent as to all international controversy and politics, would ultimately furnish all the armies and navies of the world with the greatest agency for universal peace—gunpowder.

The secret of extracting nitrogen from the air was known ten years ago, Dr. Eyde explained in the preliminary part of his lecture, though the method in vogue was not a practical one. Sir William Ramsay of London and the well known American chemist, Charles S. Bradley, both of whom were in the audience, were complimented by Dr. Eyde for their advanced experimentation. Mr. Bradley, it was recalled, attempted to build up a great industry at Niagara Falls, but found it too expensive to make his electrical current.

On one of the numerous fjords in lower Norway the present nitrous compound industry had its start back in 1903. Dr. Eyde was both the structural and the chemical engineer of the project. His first plant was at the little town of Frognerkilens, and there he could develop only 25 horsepower from the waterfall. He increased this power year by year, always moving his plant to meet the better water facilities, until, in 1907, he had developed 42,000 horsepower. His employees had grown in number during those years from four in 1903 to 125 in 1907.

Then the Bank of Paris and other European banks became interested in Dr. Eyde's plans and within the next few years invested millions of dollars in harnessing waterfalls, diverting whole streams through mountains, building tunnels, towers and complete villages for the workmen.

The electricity is consumed in electric arcs over which free air is passed. Nitrogen oxide is thus formed, and this, with the addition of oxygen, is converted into nitrogen dioxide. The addition of water makes the nitric acid which is used as the working basis of the commercial compounds of nitrogen.

"It is very simple," declared Dr. Eyde, "if only you have the means. And see what this industry represents. For instance, it has been taken for granted that an unlimited supply of ammunition is always to be had. As a matter of fact, this is not so. With all her strength, England could be put out of commis-

sion simply by cutting off her nitrates from Chile, the essential ingredients of explosives. The nitrate of ammonia which we produce from air, moreover, is very pure, and, according to the tests of the British navy, prolongs the life of the heavy guns, the purity of the product reducing the heat of the discharge.

Electrical Securities

By "CONTANGO"

An Explanation of Hydro-Electric Power and Its Development—Examples of Some of the Large Results Obtained—Acquisition of Water Power Rights and the Widespread Interest Excited Therein—Private Enterprise Mainly Responsible for Their Economical Use—Enormous Amount of Energy Still Conserved in Sites Located in Forest Lands —Value of the Securities of Companies Dealing in This Cheap Form of Power—Transmission Lines of the Future.

What is hydro-electric power?

Briefly, it is the electric power or current produced, or generated, by the use of waterwheels.

A water power site is said to be capable of developing so many horsepower, the term horsepower representing the energy required to lift 550 pounds one foot in one second, or, as usually expressed, 550 foot-pound-seconds. In electricity this unit of power becomes the kilowatt, that is to say, a thousand watts. The kilowatt is equal to about 1⅓ horsepower. A kilowatt of electricity used for an hour is called kilowatt hour, which is the basis on which electric companies sell their energy.

After electricity is developed by the use of water power it is passed to near or distant points by the use of transmission lines, of which more will be said later on, as the future development of the transmission lines has much to do with the value of electrical securities created by hydro-electric companies.

The first development in the generation of electricity by water power and the transmitting it long distances occurred in California. The progress was rapid. From small plants sending the power a few miles at a relatively low voltage, there came in rapid succession the building of larger and larger plants with longer transmission lines and higher voltages. The system has now spread all over the world, and while the largest plants in the world are to be found elsewhere than in California, yet the development in that state has kept abreast of the progress made elsewhere.

At the time when the electric development commenced in California the vast oil fields had not been discovered, and California was without fuel. Coal in any considerable quantities had never been discovered and that which was used had to to be imported at a high cost. Hence the necessity for some cheap form of power was the mother of the invention of the hydro-electric plant.

Mr. J. D. Galloway, member of the American Society of Civil Engineers, attributes the peculiar formation of the Sierra Nevadas as another reason for the beginning and progress of hydro-electric development in California. The mountains range from a summit elevation of about 8,000 feet in the northern to over 14,000 feet in the southern part of the state. Geologically they are of recent formation. In many parts a recent lava cap, several thousand feet thick and many miles wide, covers older formations. The rain and snowfall in the mountains ranges from 20 inches to over 100 inches. In some places the snowfall is over 30 feet and it remains well on into late summer. The result is that numerous rivers flow down the slopes of the mountains into the two collecting rivers, the Sacramento and

the San Joaquin. These branch rivers have cut deep canyons into the relatively soft lava cover from 1,000 feet to 3,000 feet average depth. The canyon of the Tuolumne River is at one place over 4,000 feet deep and less than two miles wide at the top. The descent of the rivers is swift, ranging from 100 to 150 feet fall per mile. This means a torrent of water dropping in successive falls and cascades.

Then last, but not least, is the presence of numerous large cities situated in huge fertile valleys far below near sea level, and two of the largest cities in the whole country right on the seacoast.

Such then was the situation—high mountains with heavy precipitation at high altitudes offering the power.

Having illustrated conditions in California, which have to a certain extent been duplicated as to most points in other parts of the country, one can remind the reader that at the water power site the first step is always the formation of a dam by which the water may be controlled and headed up into a greater source of energy.

Now, before passing to available water power sites, it may be well to mention some of the very large ones now in full use as generating sources of hydro-electric power. The two greatest producing centers in the world are the Falls of Niagara and the Victoria Falls on the Zambesi River, South Africa. The rights at Niagara have all long since been acquired by American and Canadian companies which form a monopoly. There is between three and four million horsepower capable of development there and, up to the present, transmission lines have been carried, by one of the companies, to points about 150 miles away. The giant plant at the Victoria Falls Power Company, in South Africa, is said to be the largest in the world, is at this time supplying the entire "Rand" with electrical energy and it too, has an absolute monopoly over practically all that part of South Africa.

Other well known hydro-electric power developments in this country are the United States Government works at Roosevelt, Ariz., the large plants on the Tennessee and Cumberland rivers, the Oregon City plant on the Willamette near Portland, the Seattle Electric Company's plant near Seattle, Wash., the Central Colorado Power Company's plant with 430 miles of transmission lines, the plant at Spokane, Wash., the plant at Joliet, Ill., on the Desplaines River, the Lockport plant of the Chicago Sanitary District near Chicago and others too numerous to mention in various parts of the Atlantic Coast and New England States.

There are many electric systems in different parts of the country which have acquired water power sites without having developed them so far. In fact, it may be stated with some show of authority that almost all the open water power sites have been acquired by the great electrical interests.

There are, roughly, 12,000,000 horsepower capable of hydro-electric development in the national forests alone. Probably half of this amount is now under the control of the United States. That half will have a minimum value when marketable of at least $600,000,000, or over a billion dollars worth of marketable value for the water power still existent in the national forests. Just now a question being agitated considerably is: To what extent can the control of additional power sites be secured by acquiring national forest lands under the guise of homestead settlement, in many instances very small tracts of arable land along mountain streams being sufficient? It is stated that though many of these tracts are unquestionably suitable for agriculture, their opening to settlement could have but one result, namely, speculative entries for their future value for the development of hydro-electric power. As soon as a legal title to such entries could be trans-

ferred they would be acquired by power companies. This has been done in the past in many parts of the west through homestead and preëmption entries and mineral locations.

Such power sites furthermore, as has been already suggested, are not necessarily acquired by power companies for immediate development and use. In many instances the sole purpose is to control undeveloped power and prevent its passing into the hands of possible competitors. These sites will be held, as others are being now, until the market permits the development and sale of electric energy without affecting the prices paid by consumers.

Having thus shown what is the general situation in regard to hydro-electric power at this time, it must be made clear that the final value of stock and bonds issued by such hydro-electric companies and systems greatly depend on the future service derived from the lines of transmission. No less a financial authority than the president of the National City Bank, of New York City, has had this to say: "The utilization of the great water powers which are now being so rapidly developed will tend toward a combined management covering large areas. The progress that is being made in long distance transmission is of the greatest importance in this direction. Indeed, if a layman might venture an opinion, it would be that the next era of distinct development in the electric lighting field will come as a result of the progress that the technical experts will make in long distance transmission." This does not conflict with the opinion of Herr Rathenau, of Berlin, "the electrical emperor of Germany," who expressed himself some years ago to the effect that in "concentration of the areas of distribution" would be found the next great electrical development of the times—meaning that he saw no reason why there should be more than one distributing system within a radius of 50 miles. Therefore, what as to lines of transmission at the present time?

One cannot do better here than quote a few words from a paper read in May of this year by C. A. Keller before a branch meeting of the National Electric Light Association. "Our great national problem of the conservation of energy, as well as the inevitable struggle of industry for cheaper power, will find their solutions in the transmission line—the ultimate scarcity of fuel will finally drive civilization southward, and here again the transmission line will come to the rescue by delivering to industry energy developed at the great water plants of the North. This can only be accomplished by transmission lines operating at considerably higher voltages than at present." And he might have added, very considerably lower cost. Here are some of the important long distance transmission lines operating at 60,000 volts or over:

Central Colorado Power Co., 100,000 volts—450 miles of transmission lines.

Great Falls Water Power and Townsite Co., Montana, 102,000 volts—135 miles of transmission lines.

Ontario Power Company, 60,000 volts —200 miles of transmission lines.

Washington Water Power Company, Spokane, Wash., 60,000 volts—260 miles of transmission lines.

Copper is used almost exclusively for these transmission lines. There are in places aluminum lines, especially for long spans. There is also braided copper in steel sheath.

You, being interested in investment in electrical securities, will be wise to give close attention to the hydro-electric power developments of the day, for in the march of progress, you will find there a great opportunity. Just now, this manner of abundant and cheap power is very much a matter of country, nay world wide, interest and you will do well to watch events closely, and be ready to take advantage of some of these adequately managed hydro-electric opportunities.

SCIENCE EXTRACTS FROM FOREIGN JOURNALS

NEW WAY OF USING RADIUM

An interesting method for using radium for different kinds of work is now employed in Europe. Seeing that glass or aluminum vessels containing radium have the drawback of shutting off a good part of the useful rays given out from this substance, M. Lieber employs a special method for covering surfaces with radium so as to make what may be called an active screen. To do this he dissolves or mixes the radium compound so as to be able to spread it upon a celluloid backing in the shape of a disk or plate. A celluloid rod can also be coated in the same way. After drying, the layer of radium is covered with a coating of collodion, which dries quickly and then gives a good protective layer. It also allows a good part of the radium rays to pass. What is known as "radium gelatine" is also used for a number of purposes, and at present it is employed for medical use. It consists of a sterilized solution of gelatine containing a small quantity of radium salt. When the ordinary means fail, the radium gelatine is injected into parts of the body or it can be applied upon wads of absorbent cotton.—*Les Inventions Illustrées, Paris.*

ELECTRIC HEATERS FOR CHURCH PEWS

Electric heating is carried out in the St. Sebaldus church in Nuremburg, Germany on a most improved plan, the heaters being installed in the shape of foot warmers, which run along under each pew, and the result is said to be excellent. The outside electric mains come in to half a dozen or more connection boxes lying under the floor and from here wires branch out to each of the pews and on the pew is a switch so as to be able to cut out each heater independently. The electric heater consists of a four inch iron pipe laid along at a short distance from the floor and in front of the seat so that the feet can be placed upon the heater. A foot support in the shape of an iron plate runs along just over the heater tube so that there is no direct contact made with the latter. Inside the tube is the electric heater proper, which consists of resistance wire wound on a central metal core, being insulated with glass supports. The foot bench acts as a flap and is hinged to the back of the pew following and has feet in front, so that it can be folded up when it is desired to inspect or clean the heater. The St. Sebaldus church is a large one and has 1,200 seating places, with 1,800 feet total length of pews.—*Elektrotechnischer Zeitschrift, Berlin.*

ST. ELMO'S FIRE

The curious electrical phenomenon, known as St. Elmo's fire, was observed on a trolley wire of the Louvre-Vincennes line at Paris by M. Vaudequin, and he says that there was a continuous flame like brush all along 100 feet of the wire and about 20 inches high. This lasted for more than half a minute and had a pale green color which could be very well seen on account of the dark clouds which were back of it. It is well known that such effects are electrical discharges which take place during stormy weather and have the appearance of flames or brush discharges, such as are given with electrical apparatus, for instance, when approaching the finger to a static machine. The St. Elmo's fire is often seen on the masts of ships and in Paris it is noticed on the spire of Notre Dame. Sometimes the effect is remarkable, such as was seen at the Pic du Midi Observatory in France. Here the spectacle which occurred at night was a striking one, as all the lightning rods, stay wires and a 200 foot length of wireless telegraph antenna, the metal roofs and even the weathercock were covered in part or altogether by flames or dis-

charges reaching eight inches in height and there were seen brilliant stars of a small size upon the metal. The whole southern half of the observatory seemed to be in flames, while the northern half remained in complete darkness. After a quarter of an hour the storm abated, and the St. Elmo's fire disappeared altogether.—*La Nature, Paris.*

NEW WAY OF MAKING QUARTZ TUBE LAMPS

A Paris constructor, M. Berlemont, uses a new method for making quartz tube mercury vapor lamps which makes them much more reliable. These lamps are now coming into use for water purifying purposes, and are made with a quartz tube instead of glass, so as to allow the microbe destroying ultra-violet rays to pass through. But these lamps are noticed to run down with time and become useless, so that this is likely to hinder the use of the lamps unless a remedy is found. Air enters the tube by degrees and combines with the mercury, and again there is deposited a black layer on the tube like that seen in an incandescent lamp. Before this, the current was taken into the quartz tube by conical ground stoppers of the non-expansion metal known as "invar." This metal expands scarcely any and thus does not work loose with the heat. Ground stoppers are used, as it is impossible to fuse the current wires in the quartz as is done with glass. However, it is found that air will enter around the stoppers, even in spite of great care, so that the inventor now uses an alloy of platinum and iridium, and by combining properly he obtains an alloy which melts at the same heat as the quartz. In this way he is able to fuse the wires directly in the quartz tube when making the lamp. He claims that by covering the wire with platinum in a certain way, it will not work loose under the action of heat, so that this drawback is remedied and there is also no black deposit in the lamp. —*La Nature, Paris.*

HUMAN COMPASS

While we cannot vouch for the truth of the statement made by a Paris journal that the human body may be made to act like a compass and place itself due north and south, the idea is an interesting one and is said to be not difficult to prove by an actual trial. Take a wide plank as long as the person's body, insert at the middle point a sewing thimble or other suitable hollow metal piece, placing the whole upon a metal pivot fixed in the ground and about 20 inches high, so that the board can turn about easily. The person lies upon the board, with the arms laid next the body. It is claimed that the board will then turn about and finally take a position which is just north and south. Thus we have what might be called a "human compass."—*Soleil* (daily), *Paris.*

ELECTRIC TIMING AT THE OLYMPIC GAMES

At the Olympic games at Stockholm there was used a novel electric method for timing the runners in some of the races, so as to get the exact time made by the winner, and also to decide who crossed the line first, even when the difference was very small. The starter gave the signal by firing a pistol and this was connected by electric wires with two stop watches and these commenced to run for taking the time. The start and finish were at the same point, and across the track a light string was stretched between poles and the string was also connected with the stop watches for stopping them. The first comer broke the string when crossing the line so that the watches were stopped and the exact time between start and finish could be seen. Breaking the string also served to work an electric device for the shutter of a camera which was mounted just on the finish line and above the judges' stand, so that the photographer had an image of the winner when crossing the finish line. This method is very useful in settling all disputes.—*La Nature, Paris.*

TELEPHONES PER CAPITA IN SCANDINAVIAN COUNTRIES

It has often been stated that Sweden is in the lead among European countries as to the number of telephones which are in use with relation to the number of inhabitants, especially in Stockholm, where the public uses telephones very largely. Denmark is also not far behind, and the same state of affairs is found at Copenhagen. The recent telephone figures bring out the number of telephones per 1,000 inhabitants which are in use in some of the large cities. In Stockholm this number is no less than 191.5 telephones per 1,000 persons, and Copenhagen follows this with 96.5 telephones. Next comes New York with 85.5 subscribers per 1,000, then Christiania with 68.9, Helsingfors with 59.5, which is the same figure as for Berlin, then come Paris and London with only 27.4 subscribers. In several of the above cases it will be seen that the Scandinavian region is in the lead.—*Zeitschr für Schwachstr.*

INTERNATIONAL CONGRESS OF ELECTRO-CULTURE

The French Moto-Culture Association, whose headquarters are at Paris, is now organizing an international congress of electro-culture as well as a concourse and exposition of all kinds of motor devices applied to agriculture, to be held at Rheims from the 19th to the 27th of October. The congress will deal with the influence of electricity on the growth of plants, such as the effects of atmospheric electricity upon the soil and upon the sprouting or general growth of crops of different kinds, also the effect upon microbes and insects. Electric treatment of plant diseases will be another feature, also electric forcing of plant growth, influence of electric light on plants and flowers and the like. The second part of the program relates to exhibitions of electric or other motors as applied on the farm for all kinds of work.—*Revue Scientifique, Paris.*

GASOLINE-ELECTRIC OMNIBUSES IN LONDON

A number of the new Tilling-Stevens electric automobiles are beginning to run in London and others are now in use in Liverpool, and they appear to be having considerable success. Each automobile carries a miniature electric plant and this can also be made use of to supply current, as for instance, for electric welding or for operating searchlights, and the cars are used in this way at present. The motor is of the four-cylinder gasoline type and gives 90 horsepower, having a dynamo mounted on the same shaft. On the car is an electric motor which receives the current from the dynamo. This motor drives the rear axle by a set of gearing, and as the current from the dynamo passes through a controller, the driver can easily vary the current and so run the electric motor at different speeds to operate the car. A certain number of the new cars are now in public use in London and they are well patronized by the public. In spite of their seeming complication, they are easily handled, and a noteworthy point is the economy of running which they show when compared with the usual gasoline omnibus. The same type of omnibus is coming into use on the continent, and a number of them have also been built for India.—*Electricien, London.*

LONG DISTANCE WIRELESS RECORD FROM PERSIA

It is somewhat surprising that a long distance wireless record should be obtained by a station in Persia. This country seems like a bit of the old world dumped down into modernity, though the statement may not be cheering to those who are lovers of the land of "the Lion and the Sun." This isolated country is being hemmed in on the north and east by Russia and India, and possesses a coast line which commands only a byway to the Arabian Gulf. Lack of good roads is another point, and most of these are

mere caravan tracks so that means of connection with the outer world are scanty and unreliable. Wireless telegraphy is now coming in to help matters.

The operator in charge of the Marconi Jask station was recently able to cover a remarkably long distance, his messages being received by an operator on the ocean liner "Mantua," which was then off the Port of Melbourne, Australia, a distance of 6,249 nautical miles. It is only possible to account for this long distance by some exceptional conditions of the atmosphere or other physical conditions which prevailed at the time. The operator on the "Mantua" heard Jask as clearly as if the stations were only 100 miles apart.—*Marconigraph, London.*

MAP MAKING WITH THE AID OF WIRELESS

Map making is one of the new uses to which wireless telegraphy is being put, and this is likely to become an important feature before long, especially in the colonies or newly-developed regions where surveying work is difficult to carry out. At the Eiffel Tower plant in Paris experiments showed that the exact difference in longitude could be found by sending time signals by wireless. For instance, if it is two o'clock in Paris and the time at a second station at this moment is three o'clock, there is one hour difference between these points, and as the difference in latitude corresponds exactly to this, it is figured at once and we have the latitude of the second point with reference to Paris. This is due to the fact that the two time values are instantaneous, as the waves take no appreciable time to travel. The King of Belgium is now taking steps to apply the method in the Congo region in Africa, and it is said that a map can be laid out within two years, where it would take about ten years to do the work by ordinary surveys. A commission is now engaged in applying the wireless method to fixing the frontier between the French and the German possessions in the Congo region.—*Frankf. Zeitung, Frankfort.*

NEW BOOKS

MODERN ILLUMINATION—THEORY AND PRACTICE. Horstman and Tousley, Chicago. Frederick J. Drake & Company. 265 pages with 42 illustrations. Price, $2.00.

This work takes up the subject from the view-point of the practical workman, and is serviceable not only to electricians, but to architects, superintendents and managers of commercial or industrial establishments.

TOLL TELEPHONE PRACTICE. By Thiess and Joy. New York: D. Van Nostrand Company. 1912. 410 pages with 271 illustrations. Price, $3.50.

Like many other fields in the electrical industry, the art of telephony has advanced to a point where it must be divided into various subjects and have these treated separately in order to be presented in a volume of reasonable length. The book noted covers the field indicated exhaustively and is written for the engineer, the student and for those whose training has been practical.

SHOP MATHEMATICS. By Earle B. Norris and Kenneth G. Smith. New York: McGraw-Hill Book Company. 1912. 180 pages with 86 illustrations. Price, $1.50.

The aim of this book is to teach the fundamental principles of mathematics to shop men, using familiar terms and processes, and giving such applications to shop problems as will maintain the interest of the student and develop in him an ability to apply the mathematical and scientific principles to his every-day problems of the shop. This volume (Part I, Shop Arithmetic) presents the first half of the instruction papers in Shop Mathematics, as developed and used by the Extension Division of the University of Wisconsin.

DRAFTING INSTRUMENTS AND HOW TO USE THEM. By Ralph F. Windoes, South Haven, Mich. 1912. 48 pages with 88 illustrations. Price, cloth, 75 cents; paper, 50 cents.

A book written for students beginning the study of mechanical drawing. Besides treating of instruments used, a chapter is devoted to blueprinting and tracing.

On Polyphase Subjects

Edison Among the Great Manufacturers

The leading article in this issue—"Edison as a Manufacturer"—emphasizes a phase of the man's many sided personality not very widely appreciated by the public, which has come into the habit of loving and honoring him more as a great inventor and philosopher. But Edison the manufacturer, assisted by very able men with whom, through his keen insight into human nature, he has been able to surround himself, has also built up a great industrial organization at Orange, N. J. He is a thorough business man and a good portion of the long hours he spends every day at the plant is given up to the management and even to directing details of the numerous manufacturing units which are linked together under the name "Thomas A. Edison, Inc."

The author of the article, Mr. H. Bedford-Jones, visited the plant at Orange and conversed with Mr. Edison concerning this phase of his work. The results of this interview and his close observation of the wonderfully interesting and diversified processes of manufacture there represented he has set forth in a pleasing style.

This is the first of a series of articles by the same author which will present some of the very interesting features in connection with great manufacturing institutions in the electrical field. When you place a telephone receiver to your ear and listen to the voice of a friend far away, you would perhaps like to know something of the greatest telephone manufacturing establishment in the world, which builds telephones and intricate switchboards not only for this country but for China, for Russia, for France—wherever, in fact, the human voice pulsates over wires. When you see a mighty waterfall harnessed, or listen to the song of a 20,000 horsepower turbo-generator, you would like to know where those great machines came into existence. As you turn the current into a little wire heating element that then cooks your dinner or curls your hair, you wonder, also, where these modern devices come from.

The articles will answer some of these questions which have come to your mind. Not every great plant can be described nor can one one-hundredth of the marvels in each be dwelt upon, but at least some very interesting bird's-eye views will be presented of the leading institutions in the various branches of the electrical industry.

Neon and Electric Waves

It has been ascertained that the rare atmospheric gas, neon, readily becomes luminous under the influence of electric waves, and it is suggested that the property may afford a means of visually reading wireless telegraph messages. Experimentation with a tube of neon during an Atlantic voyage in July showed that the gas glowed beautifully in response to the waves sent out from the wireless apparatus of the ship, but that the received waves were apparently too weak to affect it sensibly. Further experiment may result in the discovery of a means of utilizing this property of neon as a detector of received signals. At present it is employed to measure the length of electric waves sent out.

Dr. Marcus Herz, of Berlin, once said to a patient who read medical books diligently in order to prescribe for himself:

"Be careful, my friend. Some day you'll die of a misprint."

* * *

"Hello, Jack," called out little Harry, "is Tommy in the house?"

"Course he is. Don't you see his shirt on the line?"

* * *

The other day a young woman teacher took eight of her pupils through a museum of natural history.

"Well, my boy, where did you go with your teacher this afternoon?" asked the mother of one of them on his return. With joyous promptness he answered:

"She took us to a dead circus."

* * *

He passed the sugar-bowl to a shy young girl of about fifteen, sitting across the table, saying, "Sweets to the sweet, you know;" whereat the little miss handed him the plate of crackers, remarking, "Crackers to the cracked."

* * *

The residents of a neighborhood in Harlem were surprised the other morning when on their way to the subway station they noticed this sign hanging in the window of an undertaker's establishment:

"Why walk around in misery when you can be comfortably buried for $35?"

* * *

A teacher wishing to emphasize the importance of the ocean cable in binding together the nations of the earth, inquired of her class:

"What one thing unites more people than anything else in the world?"

The unhesitating reply of a pupil was, "Getting married."

* * *

He danced a waltz with the wife of his host. The lady spoke with an especially broad accent, and she ran somewhat to flesh. When they had finished the round of the floor she was panting in a repressed and well-bred way.

"Shall we try another whirl?" inquired the Chicago man, eagerly.

"Not now," she smiled, "I'm so dawnced out."

"Not by a long shot," said the Chicagoan with emphasis. "You're far from being darned stout. In fact, you're put together better than any little girl I've seen yet."

* * *

He had dropped a nickel in the slot of a telephone pay station and stood patiently waiting. He was full to the brim. He read the instructions and took down the receiver.

"Number?" asked central.

"Fife centsch."

"What do you want?"

"Sen Sen."

* * *

Doubtless that Vermont widow meant well when she erected a monument to her late husband bearing the inscription: "Rest in peace until we meet again."

* * *

A man called up a big office on the telephone and got a saucy greeting from an office boy while asking the man who he was and what he wanted.

"Oh, I'm only the president of your company," the man answered, "so you needn't be polite to me; but please do be to others."

* * *

Two farmers of Kansas were discussing a recent cyclone. "Was your barn damaged any?" asked Si. "Wal, I dunno; I ain't found that barn yet."

* * *

"Do you think telephone operation can be classed as a profession?"

"Well, it certainly is a calling."

* * *

Three strangers were in the Pullman smoker, when one of them turned to another and asked:

"H-How f-f-f-far is it t-t-too P-P-P-Pittsburgh?"

The man addressed made no reply, but got up and left the car. The stutterer then turned to the third man, who gave him the information.

A few moments afterward the third man met the one who had left the car and said:

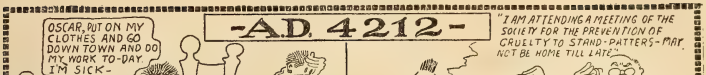
"See here! Why did you go out without answering, when that man asked you a civil question?"

"D-D-Do you think I w-w-wanted to g-g-get m-my head knocked off?" was the answer.

* * *

"What are you doing with that parrot?"

Stammerer: "I'm j-j-just t-t-t-t-eaching him to sp-sp-speak."



FOR I DIPPED INTO THE FUTURE FAR AS HUMAN EYE COULD SEE –
SAW THE VISION OF THE WORLD AND ALL THE WONDER THAT WOULD BE——
TENNYSON

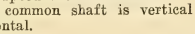
A CURSE SHALL LIGHT UPON THE LIMBS OF MEN; BLOOD & DESTRUCTION SHALL BE SO IN USE AND DREADFUL OBJECTS SO FAMILIAR, THAT MOTHERS SHALL BUT SMILE, WHEN THEY BEHOLD THEIR CHILDREN QUARTERED BY THE HAND OF WAR— SHAKESPEARE (MARKEY'S VERSION)

Common Electrical Terms Defined

In this age of electricity everyone should be versed in its phraseology. By studying this page from month to month a working knowledge of the most commonly employed electrical terms may be obtained.

TURBO-GENERATOR.—An electric generator coupled to a high speed steam turbine. In some machines the common shaft is vertical and in others horizontal.

TWIN CONDUCTOR.—A cable of electrical conductors in which two wires insulated from each other are carried. (See cut.)



Twin Conductor

UNIPHASE ALTERNATOR.—An electric generator which produces single phase alternating current. Sometimes called a "uniphaser."

UNIVERSAL DETECTOR.—A wireless detector so constructed that it may be operated as an electrolytic, tantalum, peroxide of lead, silicon, carborundum, or as any of the crystal detectors.

UNIVERSAL DISCHARGER.—See Discharger.

V.—Sometimes used as an abbreviation for volt.

VERTICAL MAIN.—In the wiring of a building for electric light and power the conductors running vertically from floor to floor. Called also risers.

VIBRATING BELL.—A bell that rings while the circuit is closed and having a circuit-breaker operated by its own motion.

VOLT.—The unit of electromotive force. If a source of electricity capable of furnishing an electromotive force of one volt is connected to a circuit of one ohm resistance a current of one ampere will flow. The nearest and most familiar approximate standard is a Daniell cell which gives an electromotive force of 1.07 volts.

VOLTAGE.—The electric pressure of a circuit expressed in volts. When this term is applied to lamps, however, it means the voltage of the system upon which the lamp is designed to burn.

VOLTAIC ARC.—See Arc, Voltaic.

VOLTAMETER.—An electrolytic cell arranged to measure the quantity of electricity that has passed through it in a given time. If two plates of copper be placed in sulphate of copper and a current of electricity be passed through from one plate to the other the anode plate will slowly dissolve and the kathode plate will receive the copper deposit lost by the anode. One ampere will deposit 1.174 grams of copper per hour. In 1879 Edison proposed a copper voltameter to measure current supplied to houses for electric lights.

VOLTA'S BATTERY.—See Battery, Volta's.

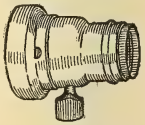
VOLLMETER.—An instrument used for measuring the potential or electric pressure.

VULCANITE.—A variety of vulcanized rubber used for insulation purposes in electrical construction. Sometimes referred to as ebonite, when black. A more common name is hard rubber.

W.—An abbreviation for watt.

WALL BOX.—An iron or steel box required by the National Electrical Code to be set in a wall or partition to hold a flush switch or plug receptacle.

WALL SOCKET.—A socket designed to be placed upon the wall to hold an incandescent lamp. (See cut.)



Wall Socket

WATT.—The unit of electric power. The $\frac{1}{746}$ of a horsepower.

WATT-HOUR.—The term used to indicate the steady expenditure of one watt of electrical energy during a period of one hour.

WATTMETER.—An instrument for measuring in watt-hours the electrical energy passing through it. (See Watt-hour.)

WAVE LENGTH.—Used in wireless telegraphy to designate the distance between two adjacent points at which the electrical strain in the ether is at its maximum in the same direction. A rough analogy to wave length in ether may be made by dropping a float regularly into a pool of water. Waves will be produced, the distance (wave length) between their crests being in accordance with the rapidity of the oscillation of the float.

WIMHURST MACHINE.—A type of static machine having two oppositely rotating plates of glass on which are pasted sectors of tinfoil. These sectors on the two plates react one upon the other, becoming charged with electricity which is taken off by collecting combs of metal.

WINDAGE.—The air gap between the armature windings and the pole pieces in a dynamo is sometimes so called.

WIRELESS TELEGRAPHY.—A method of electrical communication between two stations without the use of a metallic circuit. The principle of wireless communication as specified in Marconi's patents is the production and detection of electro-magnetic waves, the ether being the transmitting medium.

WORK.—When a force acts upon a body and moves it this force does work, it acts against a resistance and produces motion. The common unit of work is the foot-pound. If a weight of one pound be lifted one foot, a foot-pound of work has been done. Foot-pounds equals pounds-force times feet displacement.

POPULAR ELECTRICITY MAGAZINE

In Plain English

HENRY WALTER YOUNG, Editor

Vol. V December, 1912 No. 8

CONTENTS

	Page
ELECTRO-CHEMICAL WONDERS	753
Lighting as an Art	755
Protecting Nitro-glycerin Works from Lightning	756
Strange Electric Battery Plant	756
Harper Memorial Library, University of Chicago	757
SOUND SIGNALS BY THE RIES SYSTEM	758
Fire Boat Electric Search Light	759
Dignity of the Electric Sign	759
THE POWER BEHIND THE PHONE	760
Floating Dry Dock for British Battleships	767
"Fotregrele" to Prevent Hail Storms	768
Labeling Seattle's Railway Station	769
Electricity on Fujiyama	769
Turning Down Electric Lights	769
How Much Will It Cost?	770
Mammoth Bouquet Advertises Electric	770
Electric Ice Making	770
The Pullman Automobile Has Arrived	771
Electric Conquest of the Pyrenees	771
Giant Talking Machine	772
Luminous Marble Walls	772
The Motorcycle and the Trouble Shooter	773
Coal Equivalent of Niagara Falls	773
Electricity in Research	773
THE PURGING OF RAW GOLD	774
Our First Electrically Driven Naval Vessel	777
Steel Refining Furnaces	779
Is It Possible in This Age?	779
ELECTROCUTION	780
Electro-magnet for Treating the Eye	784
Electricity to Attract American Tourists	784
An English Electro-plating Process	784
Deep Sea Fish Carries a Searchlight	785
Dressmaker's Illuminated Sign	785
MOVING PICTURES OF BULLETS	786
Effects of the Metallic Filament	787
Stepping on Mat Signals Elevator	787
An Automatic Table Waiter	788
Warns the Man Behind	789
Temperature of the Arc	789
The Electrics of Taste	789
IN THE COPPER COUNTRY	790
Duster for Vacuum Cleaners	795
The Speaking Automaton	795
The First Carborundum Furnace	796
Moving Pictures for the Blind	796
Motors in the Quarrying of Sand Stone	797
An Artificial Aurora	798
A Color Blending Top	798
Electric Gondola	799
Lamp Filaments	799
TELEFHONE STATIONS OF THE U. S. FOREST SERVICE	800
Special Illumination of Racket Courts	803
Electrifying the Railroads of a Whole Country	803
Electrical Music	803
Style in Trolley Construction	804
The Largest Steam Yacht	804
Tending Baby by Telephone	805
Profuse Light Pays the Jeweler	805
THE CHINESE NOODLE MAKERS	806
Magnetism and Petroleum	807
SOMETHING REALLY NEW — THE MAGNAPHONE	808
The Practical Engineer	810
A German Electric Model	812
Coaling a Warship by Searchlight	812
Cable Incline in the Tyrol	813
Tesla's Plan for Electrically Treating School Children	813
The Ontario Power Plant of Niagara Falls	815
Opportunities of the Electrical Store Window	817
Search for Particle of Lost Radium	817
Battery Cigar Lighter	818
Tire Economy	818
"Easy" Washing Machine	819
Automobile Step Light	819
Measures the Cost of Operation	820
A Compact Portable Stereopticon	820
Bell Ringing Transformer	820
An Adaptable Small Motor	821
Electric Stove Welder	821
The Grinding of Stove Plates	822
Electric Truck in Twine Factory	823
A Reflecting Heater	823
ELECTRICAL MEN OF THE TIMES (Philip Stevens Dodd)	824
Hydro-electric Dam Surmounted by a Roadway	825
Ingenious Advertisement	825
Electricity in the Interest of Women	
MR. FLANNERTY GOES HUNTING	826
Brushing by Electricity	829
THE ILLUMINATION OF THE CHRISTMAS FESTIVAL	830
An Ideal Realized	832
Junior Section	
TRAINING YOUTH FOR THE ELECTRICAL AGE	834
Electric Star of Bethlehem	836
Unique Ammeter	837
Another Explanation of the Static Trick	837
New York Telephone Directories	837
DOWN "RUE DE L'ETOILE" TO THE CITY OF TOYS	838
Electric Light for Submarines	841
Why Thunder is so Loud	841
Popular Electricity Wireless Club	
60,000 Meter Wave Now Possible	842
Wireless Season	842
British Soldiers Using Wireless	843
Detectcr for Portable Set	844
An Efficient Wireless Set	844
Effect of Ionization on Wave Propagation	846
HOW TO COMPLY WITH THE NEW WIRELESS LAW	847
Eclipse of the Sun Affects Wireless Signals	852
Directory of Wireless Clubs	852
For Practical Electrical Workers	
CONSTRUCTION OF A 50-WATT DYNAMO	854
A Liquid Condenser	856
Watch Fob Lighter and Magnifyer	856
A Test Bell	857
Curious Features of Lighting	857
Photographing Birds	858
Clock Operated Time Switch	858
Industrial University	859
Water Tight Receptacle and Plug	860
Double Jet Gasoline Torch	860
Making Glass Plates	860
Electric Osmose in the Drying of Peat	861
Transmitting Phonograph Music	862
Care of Commutator and Brushes	862
New Use for Conduit	863
Reversing Switch for Small Motor	863
Illuminated House Numbers	864
Electric Testing of Water Supply	865
A Convenient Battery Tester	865
Testing the Permanence of Colors	866
Powerful Incandescent Lamps	866
Take Your Own Picture	866
Miscellaneous	
SHOULD INVENTING BE TAUGHT?	867
Turning Point in Pupin's Life	869
Making Sugar by Electricity	869
Ice Insulating Conduits	869
ELECTRICAL SECURITIES	870
Science Extracts from Foreign Journals	873
Leave the Electric Wiring Alone	875
Bakelite	875
New Books	875
Popular Electricity Magazine's Sworn Statement	876
Thomas A. Edison Honored	876
Signs Needed in Mexico City	877
Hail Storm Led by an Electric Line	877
Short Circuits	878
Common Electrical Terms Defined	880

RENEWALS When your subscription expires, you will find a renewal blank enclosed here. You should fill out and return with remittance at once to avoid missing a number. Positively no copies will be mailed on any subscription after same expires unless renewed, and we cannot agree to begin subscriptions with back numbers. The date on wrapper of your magazine shows issue with which your subscription ends. The extension on this date to period covered by renewal is sufficient receipt. If any other is desired it should be requested at time of renewal.

CHANGE OF ADDRESS Notify us promptly of any change in your address, giving both the old and new location. Since our mailing list for each issue closes the 5th of the preceding month (i. e., list for February closes January 5th), changes received after the 5th must necessarily take effect with issue for second month following. Postmaster as well as Publisher should always be notified of changes in order to forward mail sent to old address.

ISSUED MONTHLY BY POPULAR ELECTRICITY PUBLISHING CO., Commercial Bldg., Chicago, Ill.
YEARLY SUBSCRIPTION, $1.50; CANADIAN, $1.85; FOREIGN, $2.25; SINGLE COPY, 15 CENTS

No additional copies will be sent after expiration of subscription except upon renewal.

Entered as Second Class Matter April 14, 1908, at the Post Office at Chicago. Under Act of March 3, 1879.

Copyright 1912, by Popular Electricity Publishing Co.

Photo from Underwood & Underwood *Copyright by G. V. Buck*

SIR WILLIAM RAMSAY, WHOSE NAME IS HONORED ABOVE ALL OTHERS WHEREVER CHEMISTS FOREGATHER. HE MAY RIGHTLY BE TERMED THE GREATEST LIVING SCIENTIST

PUBLIC LIBRARY
NEWARK, N. J.

Popular Electricity
In Plain English

VOL. V DECEMBER, 1912 No. 8

Electro-Chemical Wonders

An Interview With Sir William Ramsay

By FRANK PARKER STOCKBRIDGE

"What is going to be the next great development in electro-chemical science? I do not know. I am not a prophet. Science has nothing to do with prophecy. Predictions are for commercial men and engineers. Science concerns itself only with facts actually ascertained, and the two most important facts bearing on electrical chemistry that have been ascertained in the last few years are that it is possible to extract the nitrogen from the air by means of an electrical furnace and convert it into nitrates for use in manufacturing fertilizers, explosives, dyestuffs and for other commercial purposes; and that we can actually make rubber—and I know of nothing more important to the development of the use of electricity than an unlimited supply of cheap rubber."

The speaker, a slender, wiry, grey bearded, pleasant faced, genial gentleman of fifty-five, with whom I was conversing in the big lounging room of the Hotel Belmont the other day, was Sir William Ramsay. And if you don't know who Sir William Ramsay is, here is a list of his titles and degrees:

In the first place, he is a Knight Commander of the Bath, which is nearly the highest order of Knighthood of the British Empire. Then, he can write after his name the initials L. Ld., D. Sc., M. D., Ph. D., F. R. S. and F. C. S.; he is a Commander of the Crown of Italy, an officer of the Legion of Honor of France, honorary member of the Institute of France, honorary member of the Royal Academies of Ireland, Berlin, Bohemia, Holland, Rome, St. Petersburg, Turin, Roumania, Vienna, Norway and Sweden, as well as of the Academies of Geneva, Frankfort and Mexico. He is an honorary member of the German Chemical Society, of the Royal Medical and Chirurgical Society, the Pharmaceutical Society and the Philosophical Societies of Manchester, Philadelphia and Rotterdam. Besides all of these he is Professor of Chemistry at the University College, London.

None of Sir William's titles and honors has gone to his head. He is as affable and democratic as he was when he was just plain Willie Ramsay, studying chemistry in his native city of Glasgow. But wherever chemists foregather the name of Sir William Ramsay is the one name of a living man that is honored above all the rest. For this wiry, pleasant spoken Scotsman, with the twinkling blue eye, has made more important discoveries in chemistry himself, and has pointed the way to more important discoveries in chemistry for others, than any other individual since the days when

chemistry was allied to magic, and the search for the philosopher's stone was the aim and object of those who were trying to penetrate the secrets of Nature.

If Sir William Ramsay had never done anything else but discover that the air, which all scientists had accepted as being composed of a mixture of oxygen and nitrogen, actually contains a number of gases and elements new to science, his name would live in scientific literature as that of a great discoverer. It is sixteen years since he found the element argon as a constant constituent of the air, and it was after that that he discovered three other atmospheric gases —neon, krypton and xenon. The element helium was also first discovered by him, and when he discovered that radium may be transmuted into helium, he found something that chemists and alchemists had sought in vain since the beginning of time—the actual transformation of one substance into another, which the "philosopher's stone" of the ancients was to accomplish. And since he was the first to tell the world just what the air is composed of, it was quite natural that when, during his visit to America to attend the International Congress of Applied Chemistry, I finally persuaded him to talk of present-day and future wonders in electro-chemistry for the readers of POPULAR ELECTRICITY, the first subject he referred to was the wonderful utilization of the air as a source of nitrogen supply.

"If you have never given the subject careful study, you cannot realize how important to the world the insurance of a continuous supply of nitrogen in some commercial form is and always will be," he said. "England would be depopulated in a short time if the supply of nitrates were to be cut off. Not only is the agriculture of Great Britain dependent upon nitrogen fertilizers, but the explosives for use in the guns of her army and navy must also be made from nitrogen compounds.

"Until Dr. Samuel Eyre of Norway and his colleague, Dr. Birkeland, discovered an economical way to extract the nitrogen from the air by means of the electric arc, the whole world of science and economics had been wondering what would happen when the only known large deposits of nitrogen—the Chilean nitrate beds—should become exhausted. Now Dr. Eyre has just told us how sufficient nitrogen to supply all the needs of the civilized world is actually being made from the air and sold in competition with the Chilean product.

"The Birkeland-Eyre process, as practiced in Norway is a very simple one. They are using some 200,000 electrical horsepower, generated by water power, and a $30,000,000 company is manufacturing the various nitrates—80,000 tons a year of nitrate of lime for fertilizer, 10,000 tons of nitrate of ammonia for explosives and 10,000 tons of nitrate of soda for use in dyeing, as well as many other products. The process is a development of possibilities which I personally had the honor of pointing out some years ago. Air under pressure is admitted to fireproof furnaces in which an electric arc of high intensity is maintained. The passing of the free air over the arc forms nitrogen oxide, the addition of oxygen converts it into nitrogen dioxide, and the addition of water into nitric acid. I am told that the process is extremely economical, the electrodes lasting three or four weeks, and the fire clay furnaces some five to six months. Certainly the product is being sold at a very low rate. But that may not continue after the Chilean deposits have been exhausted and abandoned. We may find some such condition as that which obtains with regard to alizarin.

"Alizarin is the red dyestuff from which the color Turkey red is produced. It formerly was obtained exclusively from the roots of the madder plant, and all France was covered with madder farms and gardens. Now you cannot find a madder plant in France outside of the botanical gardens. The discovery of a method of producing alizarin synthetically, from inorganic substances,

was taken up by German color manufacturers, and the market was flooded with artificial dyestuff at a price so low that there was no longer any profit in the growing of the madder plants. As soon, however, as the madder had been rendered practically extinct, the price of alizarin began to go up. I am not criticizing the manufacturers. That is commerce, and commerce is war.

"Just at present we are facing a situation that may be similar, with regard to indigo. Indigo dye can be produced artificially, and it is being made in Germany and sold at a price calculated to discourage the growing of the indigo plant. It will not surprise me if in the course of a short time the indigo growers of India are compelled to abandon their plantations. Nor would it surprise me to learn that at the present price at which artificial indigo is sold, there is a net loss that is borne by the more profitable divisions of the manufacturing business, and that as soon as the supply of natural indigo is cut off, the price of the artificial product will rise.

"That may be the way it will work out with artificial rubber. The synthetic rubber is here—not something 'practically the same' as rubber, but actual rubber, manufactured out of vegetable products, and exactly the same in all respects as rubber produced from the caoutchouc gum. Dr. Perkin has told us about it and Dr. Carl Duisberg of Elberfeld, Germany, has shown us two automobile tires made from the artificial product which have run several thousand miles.

"Nobody knows what it costs to make artificial rubber today except Dr. Duisberg, and he is not telling, beyond indicating that these tires cost a round thousand dollars each. Now nobody is going to buy much rubber at such prices, but the time will undoubtedly come when improved manufacturing processes and possible governmental aid will enable someone to make rubber at a loss so small that an institution with large resources could afford to put it on the market in competition with the natural product, in the hope of driving the rubber planters out of business.

"That will be a more difficult process than in the case of alizarin and indigo, however. The natural rubber can stand a great deal of competition before its producers have to throw up their hands and quit. Rubber is now selling at around $1.25 a pound for the crude, I believe. I have friends engaged in the production of rubber in Ceylon, who tell me that it actually costs only about 25 cents a pound to produce, and shares in producing companies are paying as high as 200 per cent a year dividends.

"If artificial rubber is produced in the next ten years at a cost that will enable it to be sold at 50 cents a pound, it still will not drive the natural rubber out of the market. But these are problems for the engineer and the business man, and not for the scientist. We have produced artificial rubber—now the man of science must turn his attention to something else, and let commerce take care of the purely commercial questions."

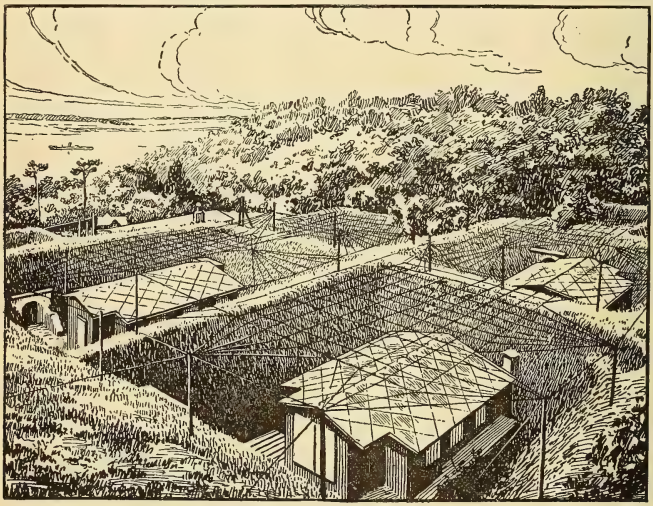
Lighting as an Art

The view has been advanced that the illuminating engineer can treat a cathedral very much as a painter does, by emphasizing the lights and shadows. Confidence has been expressed in the results to be obtained by a solution of the problem of luminous paint. There is a ceiling 125 feet square, covering a concert room in Pittsburgh which has been illuminated by a great variety of electric lights modified by screens, so as to produce the effect of a vast glowing, but harmoniously colored, Oriental rug.

It is believed that in time chandeliers will be made in the form of twisted luminous tubes and that means will be found to cause light to stream from cornices, and to make the atmosphere of a large room glow without visible means of illumination.

Protecting Nitro-Glycerin Works From Lightning

One of the great problems in the making of high explosives is that of safeguarding both the workmen and the contents of the buildings in which they are employed. Of course, the use of gas for lighting is entirely prohibited, and in some cases the electric lights themselves have been placed outside of the buildings, so that no wires whatever would enter the latter. However, the modern methods of electric wiring have made the same so safe that they are no longer a source of danger, when properly installed.



NETWORK OF WIRES PROTECTING NITRO-GLYCERIN WORKS FROM LIGHTNING

The one great risk still left for the explosive factories is that of being struck by lightning. This is minimized by dividing the works into scattered and low buildings, each of which has a network of bare wires strung above it, as shown in the sketch of a German plant reproduced herewith. These wire grids are all connected to each other and to metal plates buried deep in the moist ground, so as to form ready conductors for dissipating any difference in potential between the ground and the air above the buildings.

Strange Electric Battery Plant

Scientists tell us that there has been discovered in the forests of India a strange plant which possesses in a very high degree astonishing electric and magnetic power. The hand that breaks a leaf from it receives instantly a shock equal to that which is produced by the conductor of an inductive coil. At a distance of six meters a magnetic needle is affected by it. The energy of this singular force varies, but it is most powerful when the sun is hottest, and at times of storms its intensity increases in striking proportion. One never by any chance sees a bird or an insect light on the electric plant; nature seems to warn them that they would find their death.—*Christian Herald.*

Harper Memorial Library, University of Chicago

The Harper Memorial Library of the University of Chicago, which was recently opened, is one of the very best equipped library buildings in the world, especially with reference to its mechanical devices. The structure cost $800,000 and the income on an additional $200,000 has been set aside for upkeep. Its two lofty towers, set respectively at the east and west ends, rise 135 feet above the ground, and there are five miles of book shelves within its walls. In the magnificent reading room are 26 reading tables, at each of which fourteen readers may be seated. Besides the reading, stack, and auxiliary rooms, there are lecture halls, etc. Thus it may be seen that the equipment for all this must needs be on no inconsiderable scale.

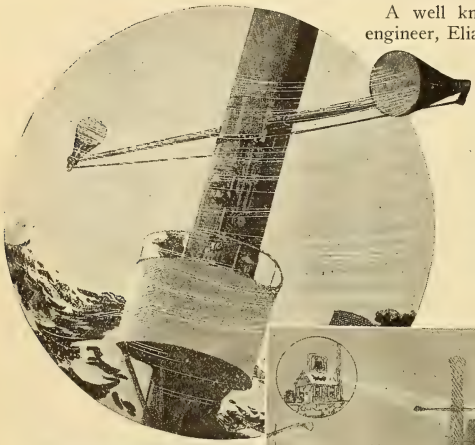
Beginning with the reading room, two large chandeliers, suspended far above the floor, are fitted with 72, 40 watt tungsten lamps each. At the present time for lighting the reading tables the experiment is being tried of setting a reflector a little distance above the table for its whole length. This reflector is a bronze trough, inverted and lined with milk glass. Tungsten lamps are distributed along this trough.

For heating and ventilating purposes, a number of electrically driven blowers have been installed. For the upper floors, the apparatus for this purpose is on the topmost floor; for the lower floors, in the basement. Exhaust fans draw off the vitiated air. The reading room has its own equipment for this purpose, for there are times, at night, for instance, when this is the only room in the big building that is open.

HARPER MEMORIAL LIBRARY

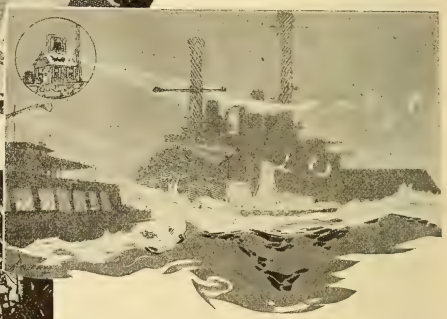
All the elevators are operated by electricity. There are three automatic elevators for the use of patrons, a non-automatic elevator for general passenger service, and a freight elevator. Books are sent from the stacks in small electrically operated automatic carriers. There are five of these. All the water that may be required for general or drinking purposes is pumped by a special equipment, electrically driven. There are telephones to communicate between those working at the delivery desk and those in the stack rooms. For transmitting orders, etc., there is also a pneumatic tube system, operated by electricity.

Sounds Signals by the Ries System



SCOUTING WITH THE RIES SOUND DETECTORS

A well known New York electrical engineer, Elias E. Ries, who has already won fame as the inventor of the regulating socket for controlling the candle-power of incandescent electric lamps, and also of the "converter" electric railroad system, to say nothing of about 150 other pioneer inventions, has just come forward with a device by which he hopes to render collisions at sea with



By courtesy of the New York World

BATTLESHIP FEELING ITS WAY INTO HARBOR IN THE FOG—SENDING AND RECEIVING VIBRATIONS WITH THE RIES APPARATUS

either icebergs, derelicts, or other ships practically impossible. Briefly stated, the device consists of a long range electrically operated pneumatic siren for projecting sound or atmospheric waves of any selected pitch in any desired direction, combined with a pair of widely separated and exceeding sensitive sound detecting, receiving and intensifying appliances pivotally mounted at the extremities of a yardarm, so arranged as to be automatically focused upon the point from which any transmitted or reflected sound originates. These operate

on the principle of the microphone with special telephone receiver attachments.

For large liners and warships the equipment consists of a "finding apparatus," comprising a centrally pivoted yardarm located preferably on the foremast of the vessel just above the lookout's nest. This arm is mounted upon ball bearings, contains a central pointer moving over a fixed scale and forms a movable acoustic base line by which the direction and distance (through knowing the angle of divergence) of the source or point of origin of the sounds can be ascertained.

Suppose a liner is steaming through a thick fog, or in waters strewn with icebergs, or in a latitude from whence a derelict has been reported. The siren would sound at intervals of from three to five seconds each minute. The echo from the siren would be reflected back from the sails and other exposed surfaces of smaller craft, unprovided with sound producing means of their own. Icebergs or derelicts would also produce an echo. The yardarm or finder is then swung into a position where the sound from both receivers is in unison and of equal strength, and the index needle fixed to the center of the yardarm will point directly toward the source of sound, no matter how distant, and the distance in miles and fractions may be read off from the scale. By turning the finder first in one direction and then in another, just as one would employ a searchlight, and noting the corresponding scale subdivisions caused by the sounds of sirens, fog horns, or bells, any number of vessels can be accurately located, one after another.

Mr. Ries has also devised a portable apparatus for military use on land, and for explorers, surveyors, prospectors, engineers, scouting and hunting, etc., in determining the direction and distance of sounds. This type of apparatus is an admirable substitute for wireless telegraphy, and can be made of any desired range within the limits of atmospheric transmission on land. The signaling range is usually from three to five miles, but when in conjunction with a stationary apparatus of somewhat greater receiving capacity, this range is increased to from ten to fifteen miles.

Fireboat Electric Searchlight

Strong searchlights upon boats and vessels have been adjudged not only a convenience but an absolute necessity. The accompanying picture shows a Carlisle & Finch electric searchlight upon the fireboat David Scannel, belonging to the city of San Francisco. The searchlight, which is located just above the pilot house, is a fourteen inch marine projector. Besides its service at fires, it is used to pick out buoys, other vessels, wharves, etc., at night.

A SAN FRANCISCO FIREBOAT

Dignity of the Electric Sign

No business has ever felt itself too dignified to use an electric sign. No church has ever hesitated to hang out an electric sign when it wanted a larger congregation. No moralist has ever found in the electric sign any hindering element, but has embraced the opportunity to use the brightly illuminated sign, recognizing the fact that there is a certain subtle influence about it, and that there is a certain dignified connection between light and truth.

The Power Behind the Phone

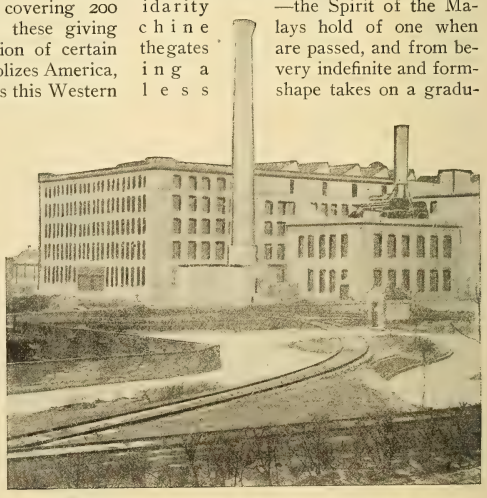
By H. Bedford-Jones

THE GATES OPEN UPON A BROAD STREET

Twelve thousand men, two and a half million square feet of floor space, an engine room of nearly 10,000 kilowatt power, forests of whirling belts and gyrating spindles, shops covering 200 acres of ground—and all these giving themselves to the production of certain electrical supplies! It symbolizes America, the paradox of history, does this Western Electric Company's plant at Hawthorne. Yesterday a host of infinitesimal energies would create a single tremendous product. Today a host of tremendous energies create a single infinitesimal product. Yesterday untold thousands of men worked for years on some very great thing such as the Pyramids. Today a host of giants works on some very little thing such as your desk telephone.

We seldom pause to realize the greatness of our little things, even though we know that the fragile moth will fret away our heaviest robes, that the delicate rust will consume our thickest armor. Pick up a strand of wire from your telephone; how long would it have required for the deftest workman of a century since to have wrapped this wire? And yet, in this wonder-palace of Hawthorne it is turned out in a few seconds. Machinery? No; something much greater than machinery, as you will see in time.

It is extremely imposing on first sight, is this central factory of the Western Electric Company, in which is built all apparatus for the Bell telephone system. The name of the concern is not spread over walls and roof in pompous display. But one's first impression is that of solidarity—the Spirit of the Machine lays hold of one when the gates are passed, and from being a very indefinite and formless shape takes on a gradu-



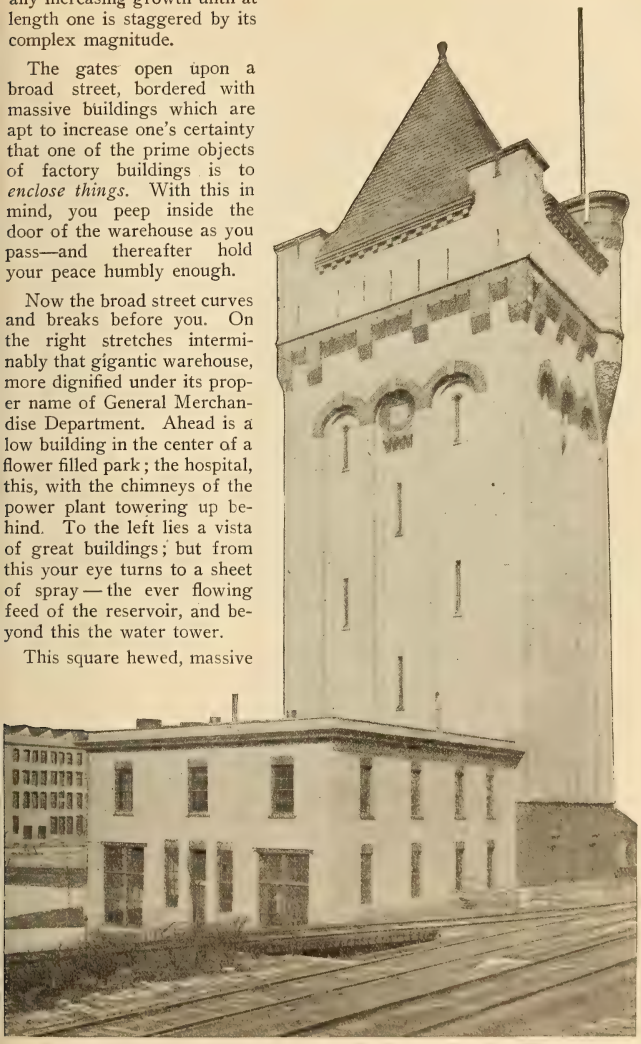
THE SQUARE HEWED, MASSIVE WATER TOWER IN THE CENTER

ally increasing growth until at length one is staggered by its complex magnitude.

The gates open upon a broad street, bordered with massive buildings which are apt to increase one's certainty that one of the prime objects of factory buildings is to *enclose things.* With this in mind, you peep inside the door of the warehouse as you pass—and thereafter hold your peace humbly enough.

Now the broad street curves and breaks before you. On the right stretches interminably that gigantic warehouse, more dignified under its proper name of General Merchandise Department. Ahead is a low building in the center of a flower filled park; the hospital, this, with the chimneys of the power plant towering up behind. To the left lies a vista of great buildings; but from this your eye turns to a sheet of spray — the ever flowing feed of the reservoir, and beyond this the water tower.

This square hewed, massive



OF THE WORKS—THE GRIM BULLDOG EVER READY TO GRIP THE FIRE DEMON

"THE VISITOR HAS BEFORE HIM STRAIGHT LINES OF AISLES SPOTLESSLY CLEAN." AT THE TOP IS SHOWN AN AISLE IN THE TELEPHONE AND SWITCHBOARD CORD BRAIDING DEPARTMENT; NEXT, ONE OF THE APPARATUS ASSEMBLY DEPARTMENTS; AT THE BOTTOM THE CORD FINISHING DEPARTMENT

tower is the center of the works — the grim bulldog ever ready to grip the fire demon. Notwithstanding that all the buildings are fireproof, fire walled into sections, and equipped with automatic sprinklers, a trained brigade of firemen is maintained, and around the plant are scattered 45 hydrant houses, which contain all necessary material. At Hawthorne the fire hazard is eliminated, or reduced to a minimum. Even should the two large pumps fail, there is another reservoir and station at the hardwood lumber yard, half a mile away, and the two stations are interconnected.

The hospital, although small, is well able to handle the 60 to 80 cases a day it receives —and it is absolutely complete to the last detail. To one who knows much of hospital work, it is a joy to find such a perfect equipment in a factory; yet it has exactly the same relation to the company's dividends as have the baseball and athletic fields, the tennis courts and restaurants, the band and the library, the men's clubs and the cases of trophies.

What an industrial concern cares about is its employees' work. And through welfare lies good work. In the spending of money today lies the saving of money tomorrow. No matter how small a hurt, every injured workman goes to the hospital; although the majority of cases are very slight, the hospital is equipped to handle everything. This is more than philanthropy—it is good business. Athletics, a mammoth restaurant, the largest in Chicago, libraries, clubs—these are not only philanthropies, but methods of business. That this is true shows in the

ATHLETIC FIELD AT HAWTHORNE AND THE GREAT POWER HOUSE THAT SUPPLIES THE WORKS

things made and the men who make them. The products of Hawthorne are electric appliances—but its by-products are *men.*

A striking instance of this is shown in the engine room. Here are placed three 2000 kilowatt steam turbines. When they were to be installed it was decided to place them on stilts instead of on a solid foundation, in order to give increased room beneath.

"That is impossible," decided the outside engineers. "The foundation must be solid."

The Hawthorne engineers decided to attempt the impossible. Today you can stand beneath those great turbines, going at top speed, and placing your hand on one of the six stilts supporting each engine, feel hardly a tremor. The stilts are steel and concrete—and the men of Hawthorne achieved another trimuph.

There are two things which stand out pre-eminent above all others in the mind of the visitor and which send him away thoughtful. I visited that gigantic warehouse, through which pass some 13,000 freight cars per year; I saw the piles of crates and boxes, each pile in limits painted on the floor, while electrical trucks loaded or unloaded them. I went through the telephone apparatus shops, with their miles of lathes and punching machinery, through slate grinding and polishing works and lumber mills. I went through the foundry and then through the cable, rubber and insulating shops, from the engine rooms to the offices, and in no part of that whole vast plant did I have to "look out for the dirt." There was none.

Progressive business is taking psychology into consideration more and more every day. It used to be argued that to stop work and pick up filings or shavings was a rank waste of time, or to have anyone else whose special task that should be. But all that is changed now.

A littered-up floor is bound to have a bad effect upon a workman. If he can simply throw his waste matter on the floor and be rid of it, the principle of carelessness is taught him by his employer. A slovenly workshop means a slovenly workman—and there are a great many big shops and factories which have not discovered that fact. The concentration of energy and the psychology of dirt are about equally important in results. They both cost something to take into consideration, but the dividends are going to show the difference in the end.

Even the foundry at Hawthorne was spick and span—for a foundry. Throughout the shops, dirt was collected, shavings and filings and dust all gathered up and sorted for future use, as soon as made. There was a machine for covering cable with lead, and another for stripping the lead from defective cable—rejected by the testers—at the same rate of speed.

This amazing cleanliness was the first thing that struck me, and the second came about in this wise. I was lunching in the restaurant building. The prices were easily 50 per cent below those of an ordinary city restaurant, and the food was excellent. About me were college men and foreigners; a Japanese student, in training for special work at a Tokio factory, a Kansas collegian, a doctor, a Yale man—all sorts and conditions of men from indentured apprentices up. My guide turned my attention from my surroundings with a jerk.

"Our great principle here," he said, "is economy in handling material. The cable shop is, say, 400 feet across. The crude rubber and wire is unloaded from the cars at one end—goes straight forward—and at the other end is loaded as cable ready for the warehouse. It always goes straight forward, and that's the same with switchboards and all the rest."

"Do you mean to say," I asked, "that the raw material can go across approximately 400 feet and come out finished?"

"I can show you a cable made on one floor of the building," he smiled, at which I promptly challenged him to do so, after lunch.

Now this process of cable making is interesting in the extreme—together with most other things in Hawthorne. At the east side of the shops the copper wire comes in. Each separate wire is now wound with thin paper of varying colors, whole rows of machines whirling in unison with a particularly dizzy effect to an outsider. Then, in the next room, two of these wires are twisted together, forming pairs of like color.

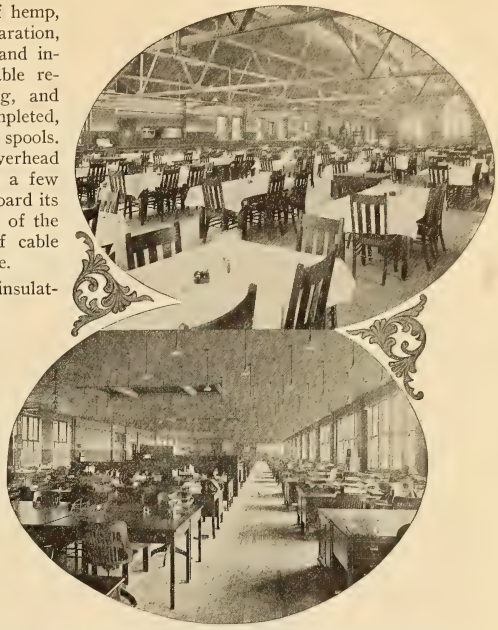
From here the paired wires pass to the stranding machines, which twist them into the required cable size. The largest which I saw made contained 600 pairs, or 1200 separate wires, and as the complete number was obtained each cable received its twisted paper cover. The peculiar twist is given, no doubt, for some technical reason known to the engineers; the color of the "pairs" has a different explanation.

Should a lineman wish to reach a certain point of a laid cable, to repair an injury, he must find which wire to reach. In the outside color wrapping is inserted a key-wire of a different color, and by counting from this on down and around, the lineman can reach the required point and pick it up again a mile farther on if he wishes.

At this stage every single wire in the cable is tested, and it is then baked to remove all incidental dampness. From the ovens it goes directly to the wonderful lead presses, where the lead jacket is applied. The cable is now completed; but for submarine uses it goes through still another process where it receives

coating after coating of hemp, wire and a tar preparation, which render it water and injury proof. As the cable receives its lead covering, and also as this stage is completed, it rolls upon immense spools. The traveling crane overhead carries these spools for a few feet, and the cable is aboard its car—at the western side of the shops. Thirty miles of cable a day follow this course.

In one room of the insulating department there are 600 girls at work wrapping the ends of switchboard cords by hand. This work demands intelligence, and these workers are of a very superior class to the ordinary factory employee. No machine has yet been invented that can do this work with complete satisfaction, but this room turns out 6,000,000 switchboard cords a year.



ONE OF THE COMPANY RESTAURANTS WHERE PRICES ARE 50 PER CENT BELOW THOSE OF THE ORDINARY CITY RESTAURANTS; ONE OF THE GENERAL OFFICES

This remarkable efficiency in handling all material is the second great feature of the Hawthorne plant. I suppose it is the same with the other factories of the Western Electric Company, and there are many others scattered about the world. Most of the European countries where telephone and telegraph lines are owned by the governments, demand that all material used be manufactured in the country itself; so that in each of the European countries the chief factory of the Western Electric has the same scope as this at Hawthorne. And the Hawthorne plant, by the way, is the largest telephone and cable producer in the world today.

Again I say that "tremendous trifles" are more impressive than mere big things. Not only this, but American business is largely built upon the skillful handling of complicated detail. And there are only two ways of winning the game of worldly success. You must either play it better than the other fellow, or you must use marked cards; and the latter method is rapidly going out of date in this country. This care and attention to the little things, this close watch over the infinitely small no less than over the infinitely big, has revolutionized Hawthorne within the past two years.

Many of the articles of telephone construction and use go through process after process, sometimes as many as 200, and all delicate in the extreme. The great slabs of slate must be bored for the switchboards without the deviation of a

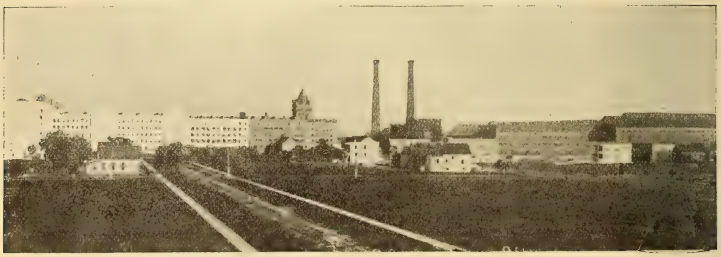
millimeter; each piece of wood or metal must be passed down from machine to machine for polishing, boring and fitting; each must pass the inspectors before going to the assembling room, while through it all run the tiny threads of neatness and watchfulness. Each building has its separate clerical force, and each department its foreman; but each department is like every other, in that the visitor has before him straight lines of aisles, spotlessly clean, straight lines of men at work, straight lines of material and machines. There is no lost energy in these shops. There is plenty of room for everyone, but there is none to be wasted.

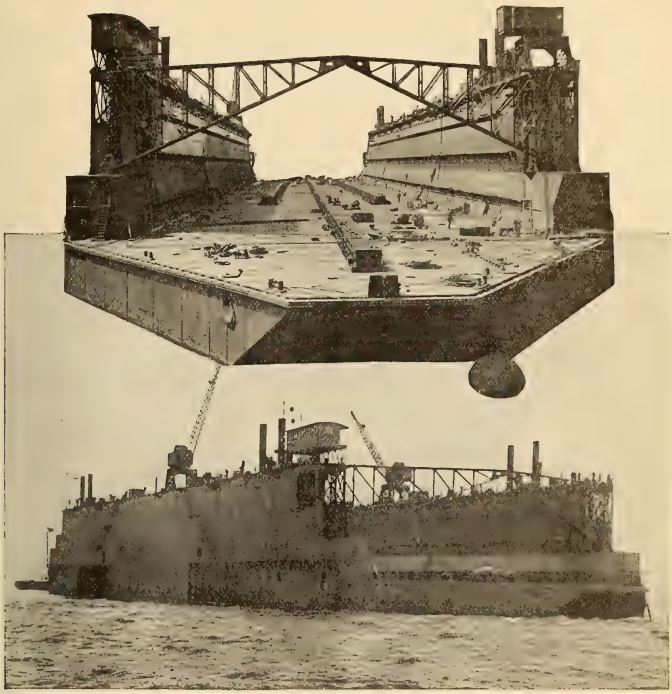
There is a double training school here. One part is devoted to the training of college men in the ways of the plant, the other is an apprenticeship for boys, who are indentured for a certain length of time. The results of this system are remarkably good. Men are developed for every possible position. Whatever they show most aptitude for is emphasized, until in time they are turned out first class men. And there is always a chance waiting. One young fellow, not yet through his course, happened to think of a simple change in making a certain mold; this change increased the output of a certain product by a third, and that young fellow found a place waiting for him on the next rung up.

Besides the nine central factories in foreign countries, there are many distributing centers. Twenty-six of these are located at strategic points in this country alone. The Western Electric shops produce more telephone apparatus than any other concern, having made the 6,000,000 Bell telephones together with all telephone exchange and accessory equipment. The place is in fact a city within a city. Taking the usual average of five to one, there are 50,000 people dependent on this one factory—more than the population of the average American city!

Nor is this splendid industrial "city" a thing of chance, upgrown by the accident of time from small to large. The whole place was built upon a city plan of its own, definite and exact to the last detail, and centered about the frowning water tower.

And so we have seen Hawthorne—ah, but have we even glimpsed it? Have we had more than the tiniest of bird's-eye views? No. For behind the miles of desks and machines, behind this play of giant forces, behind this world-thing are the little heart beats of men pulsating to the ends of the world. And still farther behind these, controlling all, forcing all forward in its indomitable will, is this thing I have called the Spirit of the Machine. Perhaps it would be more rightly called the Spirit of Hawthorne; yet it is found in every such place, and the men who create it are molded by it, for better or for worse, according as they have wrought. Here at Hawthorne is realized the truth of that thunder-text, "Where there is no Vision the people perish"—for the vision of Hawthorne is the Spirit of the Machine, the power behind the 'phone, and its people shall not perish.



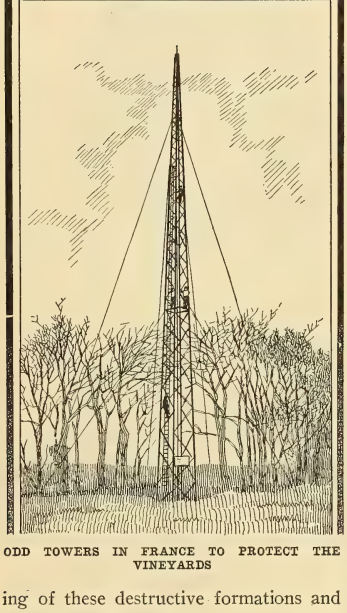


FLOATING DRY DOCK FOR BRITISH BATTLESHIPS

A floating dry dock is a huge structure of steel built with scores of compartments which may be flooded or pumped out at will, causing it to float high or low in the water. Partly submerged, the broad platform receives the ship to be docked. Then the compartments are pumped out and the resulting buoyancy causes the structure to rise, carrying a battleship on its back, clear out of water. England's greatest floating dock is shown above. It covers an area of 2¼ acres and will lift a battleship having a displacement of 32,000 tons. All power operations upon it are performed electrically. Electricity does all of the lighting, operates the capstans and traveling cranes, works the pumps, moves the massive valves to the bulkheads, drives the machine tools in the shops where repairs are made to the crippled Leviathan, etc. All of this electric power is developed by two steam driven power plants, one located in each of the two side walls.

"Paragrèle" to Prevent Hailstorms

Some French scientists have long believed that the formation of hailstones is due to atmospheric electricity, and have sought for a means to prevent the making of these destructive formations and consequent storms.



ODD TOWERS IN FRANCE TO PROTECT THE VINEYARDS

In the October, 1912, issue of POPULAR ELECTRICITY MAGAZINE, page 519, reference is made to a "paragrèle" which it is hoped will prove successful in protecting districts subject to hailstorms. Several lightning-rod-like structures similar to the one shown are to be built in the vine growing districts, and the result carefully studied. The paragrèle proper is a rod of copper supported in an upright position by surrounding framework to a height of 130 feet at least, terminating at the top in a crown of numerous blades or points. The lower end of the rod is well grounded. The setting of these conductors at intervals of six miles along the path usually followed by the storms, it is theorized, will so tend to neutralize the atmospheric electricity that the region will be immune from damage by hailstorms.

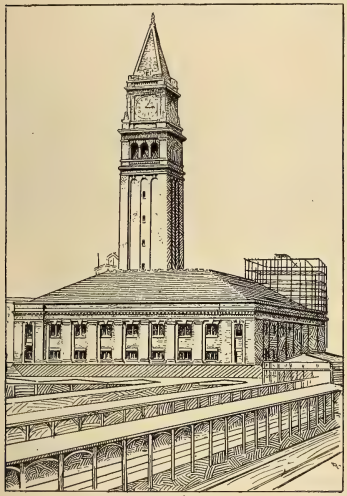
Natural Light for Mercury Lamp

All are familiar with the mercury vapor arc lamp, with its long glowing tube of luminous mercury vapor, and have noted the ghastly appearance of human beings and the great distortion of color values. This is because all the colors found in natural light (these are exhibited in the rainbow) are not present. In order for colored objects to appear natural, rays of all colors must be present in the light which falls upon these objects. The mercury vapor light is deficient in several colors. Especially are the red rays absent. This accounts for the greenish appearance of the human skin and the bluish appearance of the lips under that light.

Recently the inventor of the mercury vapor lamp, Dr. Peter Cooper-Hewitt, has improved the color value of the light by adding a fluorescent reflector. The commercial lamp is equipped with a white enameled parabolic reflector. After long research, the inventor has perfected a fluorescent reflector which, instead of reflecting all of the light incident upon it, absorbs some of the rays, and emits in return a red light. Many aniline dyes have the property of fluorescing under the action of light; that is, they absorb the rays of various colors and emit light of a different color. This new reflector appears to be made of a white fibrous material like paper, the outer coat of which is painted with an aniline dye called rhodamine. This reflector adds much red light to the deficient light direct from the lamp, with the result that colored objects are far less distorted. Human beings also appear quite normal in color. The equipment is therefore a decided improvement.

Labeling Seattle's Railway Station

A contract has been let and work has been commenced on the electrification of the famous tower of Seattle's King Street railway station. The electrical engineers will carry out designs made by Louis W. Hill, chairman of the executive board of the Great Northern. The tower of the King Street Station is a true copy of the famous tower of the Campanile,



THE KING STREET STATION, SEATTLE

which stood 1,000 years, and which was lately reconstructed. The King Street Station prototype is 250 feet high and 30 feet square.

The contract calls for installing electric signs on all four sides of the tower immediately beneath each of the four clock faces, and containing the words "King Street Station." The letters in this wording will be seven feet high, and immediately beneath each sign the initials "N. P., G. N." will appear. This wording will be visible for many miles in each direction at night. There will be five colors used, and the lights will work automatically on the sectional flash plan. The pyramidal top of the tower is already studded with small lights.

Electricity on Fujiyama

One of the latest indications of the progress of Japan in Occidental ideas is the project, which has been on foot for two or three years, to illuminate with a gigantic electric light the summit of the celebrated mountain, Fujiyama, which figures in almost all Japanese pictures, and which is one of the loftiest and most beautiful peaks in all the world.

Already the pilgrim stations on the way up the peak are heated and lighted with electricity. Since the Japanese are an artistic people, one wonders whether some of them may not oppose this startling innovation, as the people of Venice expressed their disapprobation of the scheme to light the Venetian canals with electric lamps. The scientific spirit was not strong enough in Venice to make the decision of the municipal authorities to light the canals with electricity popularly acceptable. A protest was circulated among the Venetians, in vigorous opposition to "the sacrilege." "The blinding light of the electric arcs," it said, "will destroy the beautiful effects of the moonlight and the enchantment of Venetian nights, celebrated all over the world."

Turning Down Electric Lights

Among the interesting problems for inventors is that of producing an electric light which can be turned up or down as freely as a gas jet or a kerosene light. Various devices have been employed for this purpose, such as inserting a resistance to cut off half the current, or using a lamp with a long filament run in series with a short filament; but while a reduction of the light is thus attained at will, the operation of the lamp is not economical, because the best efficiency is only obtained by running a filament at a high temperature.

How Much Will It Lift?

Probably the question most frequently asked concerning a lifting magnet is: "How much will it lift?" This depends upon the kind of material to be handled. If a solid mass of steel or iron affords a good surface for magnetic contact, a magnet like the one illustrated, having a diameter of 62 inches, will lift as much as 30 tons, or 60,000 pounds. The one shown is a Cutler-Hammer magnet, 43 inches in diameter, and is conveying a seven foot locomotive drive wheel aboard the flat car.

Mammoth Bouquet Advertises Electric

During the fall display upon "Automobile Row," Chicago, manufacturers vied with each other in making their windows points of attraction.

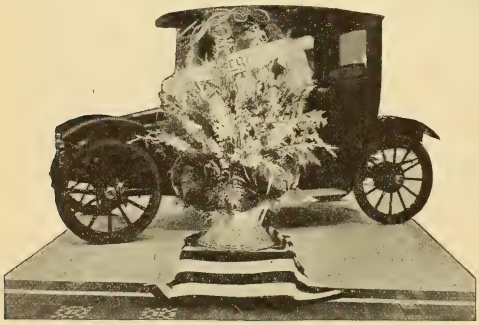
A view from the sidewalk is here shown of a window in the salesrooms of an electric car company. The center of attraction is the basket containing 144 gladioli. In the evening the beauty of this big bouquet was brought out by twelve four candlepower lamps in reflectors almost concealed by placing them on the floor close to the window.

The background is an Argo electric brougham, built somewhat similar to the well known Renault type of car, carrying 40 cells of battery, and capable of making 20 miles an hour.

LIFTING A LOCOMOTIVE DRIVE WHEEL

Electric Ice Making

It is estimated that there are now in operation in the United States about 300 electric stations provided with ice making apparatus. The unused power of the stations during the "light load" summer season is employed to run compression motors for liquefying ammonia in the process of freezing artificial ice. The plan has been especially successful with small plants supplying electric power and light for towns of less than 5,000 inhabitants. In some cases the earnings of the auxiliary ice making apparatus equal the annual return on the whole plant for other purposes, this condition pertaining, of course only in southern cities.



MAMMOTH BOUQUET IN AUTOMOBILE ADVERTISING

The Pullman Automobile Has Arrived

Luxury in motor travel, together with independence from hotels, has been achieved by U. H. Dandurand, of Montreal, in a Pullman Packard. On a three ton Packard truck chassis has been mounted a body whose interior arrangement is similar to that of a private railroad car. Twenty-five persons are easily carried on short trips, and for long journeys there are accommodations for the comfort of eleven, including chauffeur and cook.

AUTOMOBILE WITH SLEEPING COMPARTMENTS AND KITCHENETTE

The body is 20 feet three inches over all. The compartments consist of a stateroom for the driver in front, a ladies' stateroom with sleeping room for five, a men's stateroom with quarters for four. This section is also the dining and smoking room, with two extension tables and a folding desk.

In the rear is a kitchenette, compact and complete from stove to refrigerator.

The interior of the car is finished throughout with solid mahogany and the drapings are very luxurious. The carpet is of the Pullman type, also green to match the rest of the fittings. There are four telephones in the car to connect with the chauffeur, besides the electric car bells. Lighting arrangements are perfect, and consist of dynamo and two large accumulators with a capacity of 160 amperes. The front of the car has six lights—two electric, two gas and two oil. The rear has four lights, one ordinary red tail light, one electric dome light and two railway signal lamps with red, green and white lights.

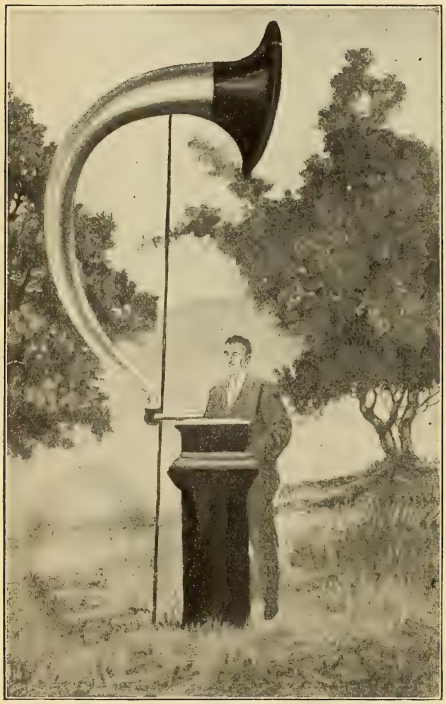
Under the body floor are five lockers containing planks to reinforce weak bridges, blocks and tackle, and an entire touring emergency outfit.

Electric Conquest of the Pyrenees

Owing to their great mean elevation, the Pyrenees form one of the most complete mountain walls in the world, capable of arresting the march of commerce as well as that of armies. Until within recent years no railways traversed the chain, communication between France and Spain being kept up around the ends. But now electricity enables engineers to attack this vast wall with success, since electric traction is possible on grades too steep for steam engines to overcome. For the Oloron-Jaca line a current of 21,000 horsepower is available, and for the Axles-Thermes-Ripoli line one of still greater capacity.

Giant Talking Machine

A description appeared recently in the London *Daily Mirror* of a talking machine which could be heard more than a mile, the invention of H. A. Gaydon. It is called the stentorphone, from Stentor, the Greek herald.



A GIANT TALKING MACHINE

An ordinary phonograph disk record is used, the sound being amplified to a great volume partly by using an immense horn and partly through the use of compressed air forced through the horn. A portable air compressor, driven by an electric motor, makes possible the giving of open air concerts and lectures.

Luminous Marble Walls

When Dr. E. P. Hyde, of the U. S. Bureau of Standards, was making a recent inspection of indoor lighting arrangements as used in Europe, he was surprised to find an old church in Italy in which the daylight was filtered through thin slabs of delicately tinted marble. The effect was a surprisingly beautiful one, and one not easily duplicated by our makers of ornamental glassware, as there is a peculiar charm about the natural coloring of some of the Italian marbles.

However, the marble has to be so thin for such a purpose that it could not form a commercial substitute for window panes or for use on electric light fixtures. Now a German, Dr. A. Pfaff, has found that such marble slabs can be used in much greater thickness if they are polished on both sides and then saturated with paraffin or shellac. By giving them such a treatment, he has been able to obtain beautiful effects in illuminating corridors by the light of tungsten lamps concealed behind the marble walls of the hallways. The loss of light is said to be only about 20 per cent (or no more than with most of the milky glassware used on fixtures), and as the whole plate of marble glows, the effect is surprisingly charming and unusual.

The electric still is exceedingly simple in construction and is therefore unlikely to break down or get out of order. By its use even the dirtiest water may be made pure and sparkling, free from germs and infectious matter which would be injurious to health.

The Motorcycle and the Trouble Shooters

The North Dakota Independent Telephone Company, whose toll lines cover nearly half the State of North Dakota, is confronted with the problem of great distances to be covered by its linemen and "trouble shooters." Naturally, it has

A TROUBLE SHOOTER AND HIS MOTORCYCLE

resorted to the motorcycle as a quick and convenient means of travel for the men. Six of these machines are owned by the company, and they are busy all the time scooting around at the rate of 40 miles an hour over the great stretches of famous wheat lands. One of the company's linemen, Mr. Jack Cooney, is shown in the picture on his favorite machine. The photographer in this case tried to make it appear that Jack uses the motorcycle in place of climbing irons, but as he didn't put his name on the photograph it is safe to call him a faker.

Coal Equivalent of Niagara Falls

It is estimated that Niagara Falls, if completely harnessed, would yield 5,000,000 electrical horsepower. About one-tenth of this available power is now serving man. It is interesting to calculate the saving in coal which would result if the falls were yielding in electrical horsepower all the energy which is now thundering over the great precipice.

Various types of steam engines require different amounts of coal in order to develop a horsepower for one hour. Assume an engine which requires one pound of coal to furnish it sufficient steam to develop one horsepower constantly for a period of one hour. In order to continue the work for a whole day 24 pounds of coal would be required. Niagara Falls could furnish 5,000,000 horsepower 24 hours per day, which in terms of coal is $24 \times 5{,}000{,}000 = 120{,}000{,}000$ pounds, or 60,000 tons. Assuming a value of four dollars per ton of coal, this would represent an equivalent of $240,000 per day. In other words, we are willing to sacrifice a quarter of a million dollars per day in order to preserve one of Nature's most wonderful spots.

Electricity in Research

The great advantage of the electrical methods for the study of the properties of matter is due to the fact that whenever a particle is electrified it is very easily identified, whereas an uncharged molecule is elusive. The smallest quantity of unelectrified matter ever detected is probably that of the rare atmospheric gas, neon. The volume of neon in one-twentieth of a cubic centimeter of air is half a millionth of a cubic centimeter, and this quantity can be detected by the spectroscope. But this amount of neon contains 10,000,000,000,000 molecules, and by electrical methods the presence of only three or four charged molecules can be detected. Rutherford has even shown that a single "alpha particle," which is a charged atom of helium, can be detected.

The Purging of Raw Gold

By ALAN R. WARD

Down on the lower end of Manhattan Island where the great sky-scrapers cast their shadows across the city, a little building sits huddled among them. It fronts narrow Pine Street where many brokers' offices are and its back is to Wall Street. All about it are the confusion and din of the financial district. Excitement is in the air. You can see it in the faces of the passers-by, in their quick footsteps, in their nervous mannerisms. Yet in the little building everything is calm. Day after day its work goes on—work conducted as quietly, you imagine, as the making by hand of fine laces.

If you didn't know you would never imagine the place to be one of the largest assay offices in the world. Behind its doors they talk of gold as other people would of salt. In its vaults lie millions of dollars. In its storerooms piles of gold bricks wait to be refined. On its floors the powdered dust when swept and examined yields thousands of dollars a year. And always to it is flowing a vast impure tide of the precious metal and always leaving it is the pure tide for which it is exchanged. And that step, the purging of raw gold, depends to a great extent upon electricity.

ELECTROLYTIC REFINING OF GOLD

WEIGHING THE GOLD

It's a tremendous task that they're handling down in Pine Street. This gold refinery recently established at the United States Assay Office is grinding out millions. Estimates place the amount of gold handled at from $9,000,000 to $10,000,000 a month. With such operations being carried on, you would suppose that conversation would be minimized. It is. If you go to Pine Street armed only with talk you'll feel that someone is staring over your head. If you go with a gold brick to sell or with the cash to buy one, you are made to feel very much at home.

But now let us see how it all worked out. A short time ago armed with some letters of introduction I went down to the new refinery. Not having any gold bricks the letters were necessary. At any

rate they seemed to work, for I was shown through the place so that the different operations were made perfectly clear.

On the first floor I noticed, as I entered, a brass window. I wondered about it until I saw a man come in very quietly and approach this window much the same as one approaches the receiving teller in a bank.

I watched the newcomer. He was the kind of a man whose appearance you would forget five minutes later. There was nothing about him that impressed you. Without saying a word he lifted the two small bundles he had been carrying, and pushed them across the counter. On the other side of the window was a man who would have reminded you of a clerk in a fashionable hotel if he'd had on a hair-line striped suit. Also, without saying a word, he took the packages. Very carelessly he removed the covering disclosing two shining bars of gold. Then without the slightest trace of excitement in his voice he asked the stranger what they weighed.

I was near enough to hear just five words. They were, "What is the alleged weight?" Later I learned that everything is "alleged weight" there until the government scales have ascertained the official statistics. A person leaving gold at the refinery leaves it secure in the honesty of the government. The question of its value is left solely to the men on Pine Street. Three days after leaving, payment is made for the metal. For gold, cash is given; for any silver in the brick, the equivalent in silver bars is paid. All other metals such as platinum, palladium, etc., that may be found in the samples become the property of the government. From this source about $90,000 a year is made.

And with this necessary digression let us go back to the brass window. After the man had been given a receipt and was turning to go away, I tried to draw him into conversation. I wanted to know how he regarded his task of carrying about $35,000 worth of gold through the streets of a city where gun fighting is frequent. For he was a typical messenger—one whose daily task it is to carry bricks to the refinery. But all I could learn was that he regarded his responsible work as a "steady job." At the suggestion of notoriety he shied as an old fashioned college professor might have done.

Then H. J. Slaker, who was brought from Philadelphia to supervise the melting and refining happened along. Also, it was a most fortunate happening. For by him I was led to the different parts of the plant, listening the while to his lucid explanations.

"Now if you were to follow that man's gold to the melting room," he began, pointing to the brass window, "you would see it placed in a crucible with a flux, smelted and cast into ingot mold."

And then he took me to a bare walled room where men in blue shirts and leather aprons were standing about. Before them was an electric puddler in which the gold was cooked and stirred. The men in the leather aprons were watching the current; they were careful to see that it was just so strong, no stronger. One of them was constantly testing it with the stirrer. And finally when the gold was evidently "done" they began pouring it. Out through a tap it came—a thick, fluid, reddish yellow, worth many, many dollars by the pint.

In little receptacles it was cooled. And while it was cooling the current went humming through the wires again—and the furnace began heating another batch of the raw material. Just before we left the room Mr. Slaker explained that the gold bars cooked by the furnace ranged in value from $100 to $18,000.

"We won't accept any bar worth less than $100," he told me. "We pay at the rate of $20.67 an ounce. If a person wants to buy gold, though, he has to take more than $5,000 worth. The gold we buy sometimes goes into coin or trade. We refine it, however, before selling it to

THE DELICATE SCALES OF THE ASSAYER'S OFFICE
FURNACES FOR HEATING TINY CRUCIBLES

the trade. Dentists and jewelers must have an absolutely pure product. We provide it for them."

Then he took me upstairs to what he called the "deposit room." Here the gold, after cooling, is reweighed. Also, from each lot the assayer takes a small sample. By this, the quality is learned and the value calculated. Then the depositor is paid. The government knows the real

value. You see there piled up thousands and thousands of dollars worth of the bright yellow metal. And when you feel like paraphrasing Samuel Coleridge and moaning—"Gold, gold, everywhere and not an ounce for me!"—you are led into another room.

And now you are about to look upon the electrolytic process of refining gold. Gold is almost always silver-bearing, and silver returns the compliment. At the refinery they don't care to leave these two metals in each other's company, so they separate them. First the gold is taken from the silver and after the operation the gold, boiled with nitric acid, attains the acme of purity. This is called "999 Gold."

After Mr. Slaker finished explaining the principle, he showed me a solution called an "electrolyte of water." It was composed of two per cent free nitric acid and three per cent silver nitrate. I tried to remember a college course I had in chemistry but I couldn't recall ever having heard of such an electrolyte before. Then he showed me the gold anodes. He pointed out that each anode was a slab of gold; that they had a hole in one end; that they were numbered and suspended in the electrolytes. He told me that the acid made the gold readily soluble.

Then began the electrolytic process. The bath was heated from 150° to 158°. If the pungent odor of chlorine arose the temperature was raised. More acid must be added, to promote the solubility of the gold. And with the current turned on, little bubbles began to gather on the anodes. More closely clustered they became until Mr. Slaker told me that each drop of water in the cells was worth ten cents. It was very pleasant to hear the word "cents" after being overcome with casual observations in the thousands of dollars. The next moment though, he had to go and spoil it by saying that in the cells were suspended half a million dollars worth of gold bars.

And then we left electricity doing its work in the nitric bath and went down to the room where the alloy was made. On the way he told me that the place we had just left was called the "gold room."

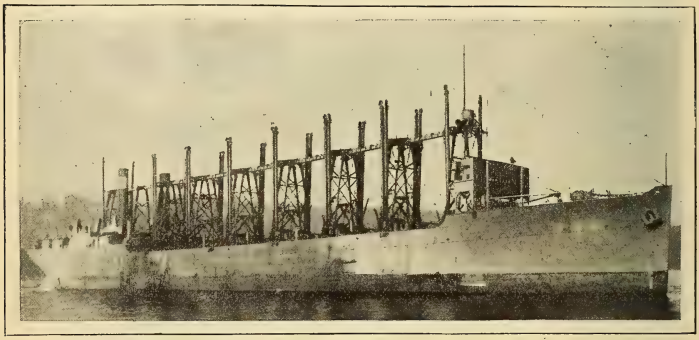
"There," he said, "we turn out pure gold. We wash it and after drying, send it down to the room where bars for the trade are made."

In the alloy room I found that the gold alloy was fused electrically with a quantity of lead, sometimes silver. The resulting alloy, which is known as the "lead button," is then fused. This is done on a very porous support called a cupel. The bones of sheep and horses, powdered as fine as flour, are used for the body of the cupel. This cupel absorbs melted oxide of lead without taking up any of the metallic globules. It is like blotting paper absorbing water, and leaving mercury behind.

If the lead is correctly proportioned, the button will consist of only silver and gold. Then these are separated by an operation called "parting." This is done by rolling the alloy into a thin plate and then boiling it electrically in a strong solution of acid. The silver dissolving, the gold is left as a coherent sponge. At first dense fumes rise from the melted metal. Then small luminous points begin to gleam on the surface. As the electric current becomes stronger and the solution hotter the points grow in size and in brilliancy. A moment later a tiny stream, reddish, is seen to trickle from the top of the metal globule. Round and round it flows—down, down until it is absorbed in the bone ash cupel. With it have been carried away the last traces of the lead and alloy. And now the gold-silver alloy shows itself in a glimmer of iridescent circling bands of yellow. It is the refined product—the finished work that the men in the leather aprons began.

Our First Electrically Driven Naval Vessel

Within the next few months there will go into commission the first electrically driven United States naval vessel ever constructed. This novelty is the collier Jupiter, and she is under construction at the Mare Island Navy Yard, Calif., being the venture of installing the electrical equipment in a battleship costing millions of dollars. On the other hand the champions of electric power realized that a try-out in a small craft would be by no means conclusive. Finally, after the question had been argued back and forth for years, what amounted to a compromise was effected. The Jupiter was to be almost as big as a battleship so



THE NEPTUNE—TYPE OF COLLIER TO BE DRIVEN BY ELECTRIC POWER

the largest ship of any description ever laid down on the Pacific Coast. In dimensions, carrying capacity, etc., the Jupiter is the exact duplicate of two other new fuel-carrying craft, the Neptune and the Cyclops. Indeed, in so far as outward appearance is concerned, she does not differ in the slightest detail from her sister ship, the Neptune, so that our readers may obtain an accurate idea of how the new electric ship will appear when completed by consulting the accompanying picture of the Neptune.

But the electrical "innards" of the Jupiter will put her in a class by herself and, if the expectations of the designers of her electrical machinery are justified, the vessel will mark a new epoch in the field of navigation.

The naval powers were at first more or less skeptical. They were willing to test electrical propulsion on a small vessel of any kind, but were unwilling to make that she could afford adequate tests, but, on the other hand, she would not represent so formidable an investment on the part of the government.

Even at that, however, the electrical interests have had to assume every risk in the undertaking. The General Electric Company, it is understood, will receive something like $60,000 if its electrical installation in the Jupiter is a success, but if it is not it must not only stand the loss on its machinery but must also bear all the expense of removing the apparatus and preparing the machinery space to receive other equipment. And many of the naval officers in authority are decidedly in a "from Missouri" attitude. One of them has been heard to say that he favors pumping the rooms occupied by the power plant on the Jupiter full of sea water in order thoroughly to test the insulation which the Navy Department insisted, when the contract

was let, must be such as to withstand the action of salt water.

The Jupiter, which has been chosen as the scene of this long step forward in the cause of electrical science, is 542 feet in length and 65 feet in breadth. As a source of energy the Jupiter has one turbo-generator and two motors. The generating unit consists of a six stage Curtis turbine connected to a bipolar alternator. Electricity is delivered by this generating unit to two motors, one mounted directly upon each propeller shaft. The speed of the motors will be changed by variations in the speed of the generating unit, the turbine being equipped with a governor so arranged that the speed may be automatically held at any point from five to fourteen knots. A feature of the Jupiter is the complete control of the movements of the ship by one man.

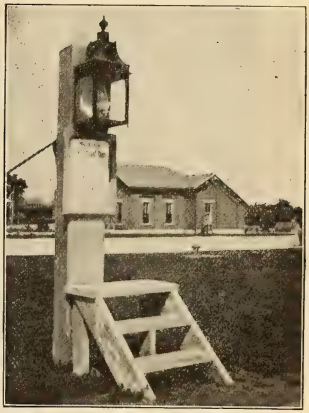
Steel Refining Furnace

One of the most important uses of electricity in German steel plants is in refining the steel. This is done in electric furnaces. The accompanying illustration shows one of these furnaces at the Stahlwerk-Becker plant in Willick, Germany, being tapped. Each of the electric furnaces will take care of 3,500 pounds of steel at a time. After the steel is properly refined it is run out into crucibles as shown and made into ingots for use in making armor plate and high class forgings.

ELECTRICALLY HEATED STEEL FURNACE

Is It Possible at This Age?

That oil lamps are in use and that the gates of a canal are opened and closed by human efforts when a 300 kilowatt power station is not 50 yards away—why is such a condition possible? However, such is the state of affairs at Morrisburg, Ont. Each day a dozen lamps have to be filled, trimmed and cleaned. One of these is shown in the illustration, the power house being in the background. Each pair of gates is opened and closed by strenuous efforts of four men. It requires about three minutes to open a pair of gates by this old time method, while electric motors on other canals do the work in less than 30 seconds, employing the services of only two men, one on each side of the canal, to control current to the motors.



THIS WITHIN 50 YARDS OF A POWER STATION

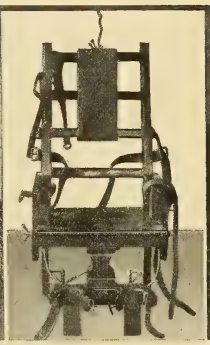
The exports of electrical machinery and appliances from the United States during 1911 were worth, in round figures, about $10,320,000, as against $16,547,300 in 1910.

Electrocution

An Account of the Practice Common in New York. Does It Really Kill?

By HEREWARD CARRINGTON—Author of "Death: Its Causes and Phenomena," "Death Deferred," etc.

DEATH CELL FOR CONDEMNED PRISONERS



THE DEATH CHAIR

CURTAINS OF THE OTHER CELLS ARE DRAWN DURING THE DEATH MARCH

Photos Especially Posed

Does electrocution really kill? Or does it only render unconscious—the patient dying, in point of fact, upon the operating table, during the autopsy?

There are able physicians who contend that such *is* the case. Again, others say that it is not. Inasmuch as a human life is in the balance, this is a point worth considering—a question of some importance, from the ethical no less than the scientific point of view.

America is the only country in the world in which electrocution is the form of capital punishment employed. There are many who do not believe in capital punishment at all; but this is not the place to argue that point. Assuming that death has to be meted out to the prisoner, what is the safest, the speediest, and the most humane way of doing so? Is it electrocution?

The preliminaries must be trying to the strongest nerves! Blindfolded, strapped into a chair, having the adjustments made to the head, feet, etc.—there is nothing heroic or stirring in this, nothing that suggests anything beyond the dog whipped to its kennel, and breathing its last alone, uncared for, destitute! It is a miserable climax to a life which might have been full of promise and hope.

The chair itself is a forbidding looking thing, at best, and suggests the torture chair of the Spanish Inquisition. I once saw a chair of this latter description, in which the unfortunate prisoners were strapped and tortured; and it assuredly looked no more ominous than the chair of electrocution. Then the death cell, caged in, as though some wild beast were within, presents a curious paradox, in our modern civilization and culture. In front of each of these death cells

(there are quite a row of them in Sing Sing) white blinds are drawn, so that when a prisoner is led between the line of cells, their inmates cannot see who it is thus led to his fate.

The prisoner once in the death chamber, the process of strapping commences, and in a few moments the prisoner is secure beyond all effort to release himself. He is blindfolded, and the service for the dead is read aloud. A physician stands in attendance, the electrician is at the switch waiting for the signal to throw it in and let forth the death dealing current. The signal is given; the lever is thrown home and this is what follows, in the words of an eye witness:

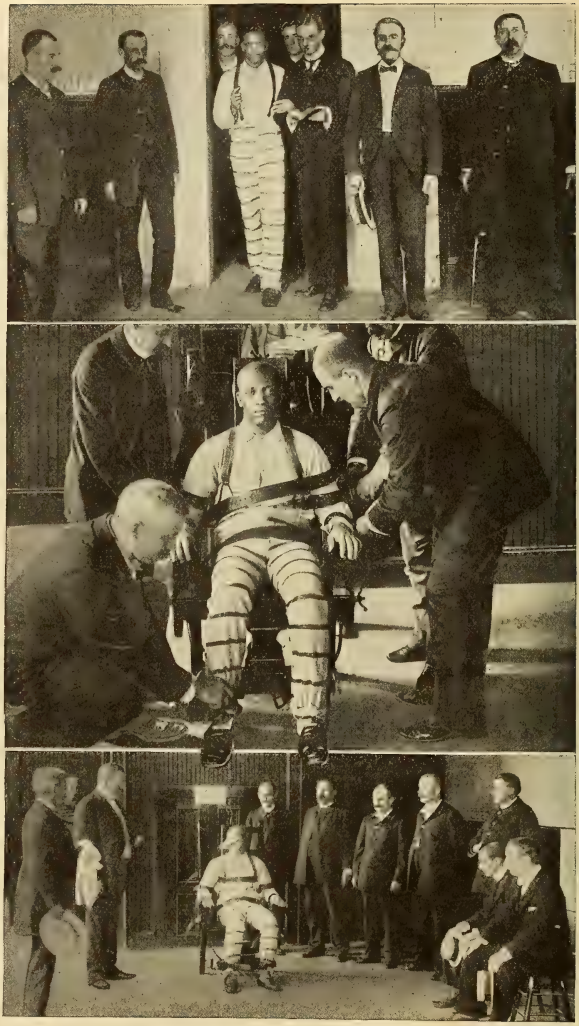
"There is not much to see. Those who would witness a killing by electricity from morbid curiosity surely would be disappointed. A deep whirring sound shoots into the air, and for a moment reminds you of the humming of a giant top. The face of the victim is hidden nearly completely by the headgear attached to the chair, so that the muscular writhing is kept from the view to a large extent. Only the mouth can be seen clearly, and the distortion is enough to make you feel glad the whole face is not exposed. As the current shoots into the body, the torso straightens out with a bound, and swells until you think the heavy straps are about to burst. The strain upon them is intense. The fearful voltage shot with lightning rapidity into the body, and circulating through every vein, makes the body quiver and vibrate so quickly that the movement is scarcely visible. The current is then lowered and the tension is taken off the body; but again the current is turned on and again the body stretches and bounds, pressing hard against the straps. Finally the lever is swung back again and what was once a man falls limp and lifeless, huddled in a heap in the bottom of the avenging chair. It is this suddenness of death that impresses: this realization that a moment before there stood before you a breathing human being, while now before you lies a lifeless corpse. The prisoner had solved the great secret."

All this might not be so bad if the electrocution really achieved the object sought. But does it? Dr. George F. Shrady, late Coroner of Manhattan, thinks that it does not, and in a letter written some time ago he said:

"There seems to be a great difference of opinion among eminent physicians and scientists as to whether the death of the criminal is actually produced by the electric current or by the doctors who perform the autopsy. It has even been hinted that the autopsy clause introduced in the law was added for the purpose of making certain of the death of the criminal.

"Prof. d'Arsonval, of the French Academy of Sciences, goes so far as to contend that the electric current merely produces suspended animation, and that the victim may be restored to consciousness and life by artificial respiration. Prof. d'Arsonval believes that the electric shock does not kill, and considers 'electrocution' objectionable and of questionable effect."

"My father," continues Dr. Shrady, "was one of the medical experts selected to witness the first electrocution in New York State—that of William Kemmler. He unhesitatingly characterized it as 'the most brutal and revolting exhibition he had ever seen,' and seemed inclined to believe that the old method of executing murderers by hanging was, after all, the most humane. Kemmler was subjected to two contacts of the electric current, lasting seventeen seconds, and 70 seconds, respectively. After the first contact the victim was pronounced dead by one or two of the physicians present, when my father called their attention to the fact that the man was still breathing, as a movement of the button on his vest plainly indicated. A few seconds later Kemmler gave unmistakable signs of life, much to the consternation and horror of those present. The current was quickly turned on again, and continued until a little column of smoke, accompanied by a sickening odor of burning flesh, ascended from



PREPARATIONS FOR AN ELECTROCUTION. AT THE DROP OF A HANDKERCHIEF ALL IS OVER *(Photos Especially Posed.)*

the body of the criminal to the ceiling of the execution chamber and passed out of a window opening to the external air. Kemmler's execution was afterwards pronounced 'a successful experiment' by the majority of those present."

Dr. Shrady is of the opinion that artificial respiration will, in a large number of cases, have the effect of restoring the patient to life, and contends that this is based on "exact scientific principles." Dr. W. G. Taylor gives a case in which the subject was completely revived, and 48 minutes after the electrocution "his pulse was 130, full and vigorous." The unfortunate man was again placed in the chair, however, and another contact of 40 seconds was made. As Dr. Taylor says: "It is certainly a grave question whether the post mortem examinations should not always be delayed until the matter of death be indisputably settled."

Dr. Gibbons gives a case in which life returned after the electrocution was performed; another physician quotes two cases. Still another says: "I am thoroughly convinced that many of the men who have been pronounced electrocuted in New York State have been placed upon the dissecting table conscious of what was going on and what was about to take place."

This hardly seems like capital punishment; it is more like human vivisection —yes, torture in its most refined form! Is this the best form of capital punishment we can devise?

It is true that other physicians do not share the views just expressed. D'Arsonval's "facts" are now questioned—even shown to be probably untrue. In the executions, as carried out today, there is no bungling, no burning of flesh, no tearing of straps. Consciousness is doubtless obliterated at once, even though *life* may not be. No sense of pain can be felt by the body when the current is turned on. It has been proved that it takes about a fifth of a second for the brain to appreciate a sensation, and one twenty-eighth of a second to telegraph that impression; and as nerve force travels only about 100 feet a second, while the velocity of electricity is millions of times greater than this, the brain has doubtless no time in which to appreciate the sense of pain.

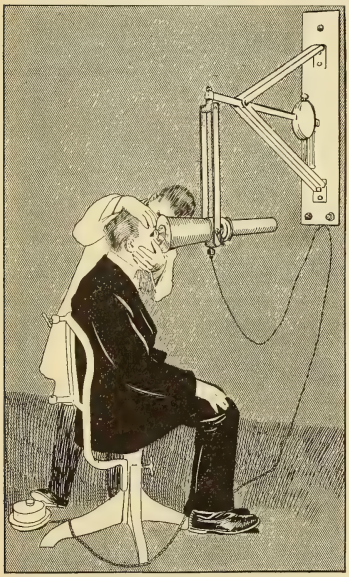
Again, Dr. R. T. Irvine, in writing on this subject, says:

"I have been present and have seen 64 persons put to death by electricity in this State (New York), and there is no doubt in my mind whatsoever but that all those men were absolutely killed by the electric shock and that death is instantaneous. The changes produced by the electric shock are such that resuscitation, in my opinion, is absolutely impossible. The amount of fresh blood found in the cranium in all these 64 cases I have seen in itself would preclude any possibility of saving a man. Then you have the patechial hemorrhages in the brain tissues. They change certain nerve cells in the brain. There is also a change in the structure of the blood after the electrical shock. Any one of these, in my opinion, would prove fatal, but when you have them all in each case and every case, as I have noticed in autopsies, death is unquestionable."

Thus, opinions differ, the weight of authority being seemingly on the side of those who say that, if electrocution is properly performed, the patient will not recover. But, as opposed to this, there are several undoubted cases on record in which a person has received even a greater voltage than that usually administered, and for a longer period of time, and yet recovered. As an example of this, I need only cite the famous case of John Branda, who received a current of 2,400 volts for nearly fifteen minutes, yet lived to tell the tale, and escaped with severe burns only. (He was, of course, completely unconscious during all this time.) Until such cases are disposed of, the question is certainly an open one and is not settled, as many seem to think. So we may ask again: Does electrocution kill?

Electro-Magnet for Treating the Eye

The application of the electro-magnet to removing particles of iron or other magnetic metal from the eye has been most successful, and physicians near metal works or in attendance upon workmen employed in such works include



NEW FORM OF EYE MAGNET

this apparatus in their office equipment.

The illustration shows one of these magnets arranged for attachment to the wall and controlled by foot pressure, leaving both hands of the physician to handle the magnet and adjust the patient. This magnet is delicately balanced by a weight and can be swung about as required. Care must be used in applying it to the eye because the strength of its pull is such that it can draw a piece of metal out through an uninjured part of the eyeball.

Electricity to Attract American Tourists

Among the returned voyagers from across the Atlantic the first and most obvious comment is the greatly increased usage of electricity within the last few years, especially on the continent itself. In fact, it might be safely said that practically all institutions designed to attract American tourists advertise their electrical supply. This may be seen best, perhaps, in England. Take, for example, a provincial town of some 60,000 inhabitants, like Winchester, which boasts considerable historical importance. Leaving the hotels out of the question, there is a small inn, dating back to the sixteenth century, whose age darkened rafters particularly attract Americans in search of the picturesque. The brass knocker may antedate Shakespeare, but within are electric lights.

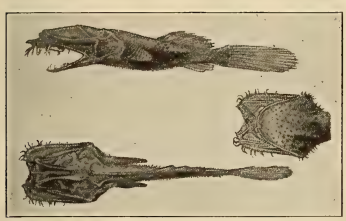
Nowhere is shown more strikingly this contrast between the mediæval and the modern than in the famous churches and cathedrals of Europe. At the time of the last coronation, electric lights were introduced in Westminster Abbey, and the great cathedrals at Winchester and Canterbury are similarly lighted.

An English Electro-Plating Process

There is an English electro-plating process whereby worn plated articles are replated by the simple plan of rubbing them with a powder of peculiar composition. The powder contains three essentials: the metal to be deposited, in pure or combined form; a salt, capable of producing an aqueous electrolyte when brought into contact with moisture and a metal that is electro-positive as regards the metal to be deposited. Silver, tin, nickel or cadmium can be deposited on any metal surface except aluminum by the English method, and the process promises to be of great value for use in homes generally.

Deep Sea Fish Carries a Searchlight

A fish which lies on the bottom of the sea, turns on a light which is fixed in the roof of its mouth to attract the prey, and, when the small fish congregate to see "what is doing," closes its terrible jaws and then sets the trap for another



DEEP SEA FISH THAT CARRIES A SEARCHLIGHT

catch; this is the strange monster which was discovered by the recent expedition to the Philippine Islands of the United States Fisheries Steamer Albatross.

A part of the investigations involved a cruise around the island of Celebes, at which time numerous dredgings were made and specimens collected off the coast and in the bays of the island. A number of deep water stations were established on the east coast, and it was while members of the expedition were engaged in the locating of one of these stations in the gulf of Tomini that the remarkable fish was discovered which is the subject of the accompanying cut. It proved to be the representative of a species hitherto unknown to science, and it was therefore necessary to coin names for a new family, a new genus, and a new species of fish. After a consultation and the ransacking of several Greek lexicons, the name Thaumatichthys was chosen for the genus, which is derived from two Greek words meaning, "a wonder," and "a fish," respectively.

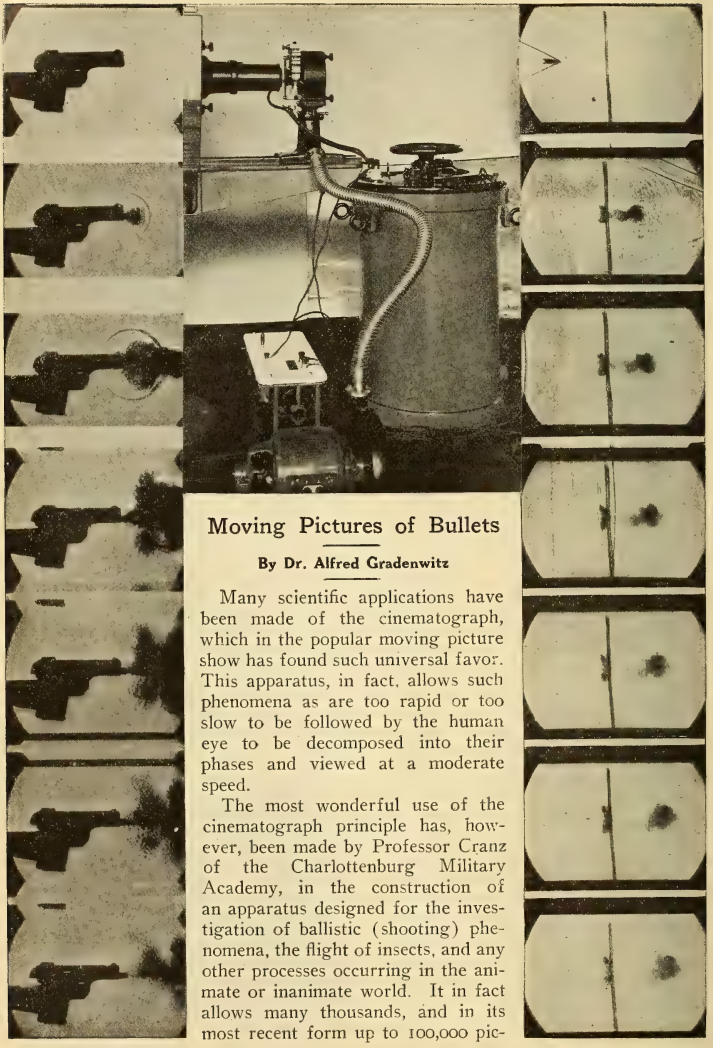
The power of attracting its prey by means of a phosphorescent bulb in the roof of the mouth is probably the most striking characteristic. The cavernous, elastic mouth is a trap into which the prey is lured and dispatched. Of the three views shown, the top one represents the side aspect of the fish, the bottom figure shows a view looking down on the same specimen, and the one in the middle is a view of the head from below. If the latter drawing is closely examined, the luminous bulb can be seen, resembling a collar button placed in the roof of the mouth, and showing in the cut just in front of the short lower jaw. The light from this bulb shines through the toothless space in the front of the upper jaw and attracts the prey which, having entered the mouth, is prevented from escaping, and brought within reach of the lateral teeth by the two pairs of large hinged, hooked teeth.

The specimen caught was brought up in a beam trawl at station 5607, near Benang Unang Island, Gulf of Tomini, Celebes, from a depth of 761 fathoms, or nearly a mile below the surface.

Dressmaker's Illuminated Sign

Many dressmakers and milliners use one room of their residence for a workshop and it is seldom that other than the conventional sign plate is used. One exception to this is a Chicago milliner who uses the front porch railing as a support for a large sign which is illuminated by four hooded incandescent lamps, the wires for which are brought up in conduit from the basement.

DIFFERENT FROM THE CONVENTIONAL SIGN PLATE



Moving Pictures of Bullets

By Dr. Alfred Gradenwitz

Many scientific applications have been made of the cinematograph, which in the popular moving picture show has found such universal favor. This apparatus, in fact, allows such phenomena as are too rapid or too slow to be followed by the human eye to be decomposed into their phases and viewed at a moderate speed.

The most wonderful use of the cinematograph principle has, however, been made by Professor Cranz of the Charlottenburg Military Academy, in the construction of an apparatus designed for the investigation of ballistic (shooting) phenomena, the flight of insects, and any other processes occurring in the animate or inanimate world. It in fact allows many thousands, and in its most recent form up to 100,000 pic-

tures to be taken in a second's time.

An endless photographic film unwinds between two drums set rotating at a high speed by an electric motor. A photographic objective of proper focal distance projects on this film the image of a mirror or a lens. The phenomena occurring in front of this mirror thus appear in outline on the film, providing the mirror be lighted by a convenient source of light. Exposures are chosen short enough so that the displacement of the film during these intervals is practically nil. This is effected by means of electric sparks, each lasting perhaps the hundred-thousandth part of a second, which are produced as uniformly as possible. These sparks are so arranged with respect to the mirror as to project on the objective of the cinematograph camera a real image of themselves. This is why the mirror appears on the films here reproduced as a surface of uniform brilliancy.

An oil condenser charged periodically by means of a high frequency generator —through a resonance transformer discharging through a spark-gap—serves to produce the sparks. In order to start and stop the latter, the alternating current is made to pass through two attachments, one of which closes the circuit at the beginning of the process to be recorded, while the other at the end of this process automatically reopens the circuit. Owing to the enormous rate at which the sparks follow up one another and to their remarkable luminous intensity, this apparatus allows several thousands of pictures per second to be produced.

The film samples reproduced herewith give a striking idea of the results to be expected from this wonderful apparatus. The one at the left shows a Browning pistol being fired, and the one at the right the piercing of a caoutchouc plate by means of a German infantry rifle. These views have been taken at a rate of 6,000 per second.

In the second and third pictures of the pistol shot, note the spherical condensation of the air around the muzzle. It is easy to infer that these are sound waves just starting out in their ever widening circles. With the film run at the proper rate through the projecting lantern, you could thus actually *see* sound pass slowly out and away from the muzzle.

The top picture on the other film strip shows the rifle ball just entering the field. Some of the intermediate pictures are left out, and then in the next one it is seen that the bullet is gone, leaving its divergent trail of compressed air behind it. A little puff of smoke and gas has now reached the plate and passed through the bullet hole.

Effects of the Metallic Filament

At a discussion of the metallic filament lamp by electrical engineers at London lately attention was called to the "slump" which its introduction had caused in the demand for electricity for lighting purposes, resulting from greater economy of current. It had even been proposed to increase the price per unit for current used for that purpose, but a wiser plan was adopted, namely, the encouragement of a wider use of electric lighting. One result of the introduction of the metallic filament was said to have been that many who had gone back to gas now returned to electricity. The predicted end is a gain for both producer and consumer.

Stepping on Mat Signals Elevator

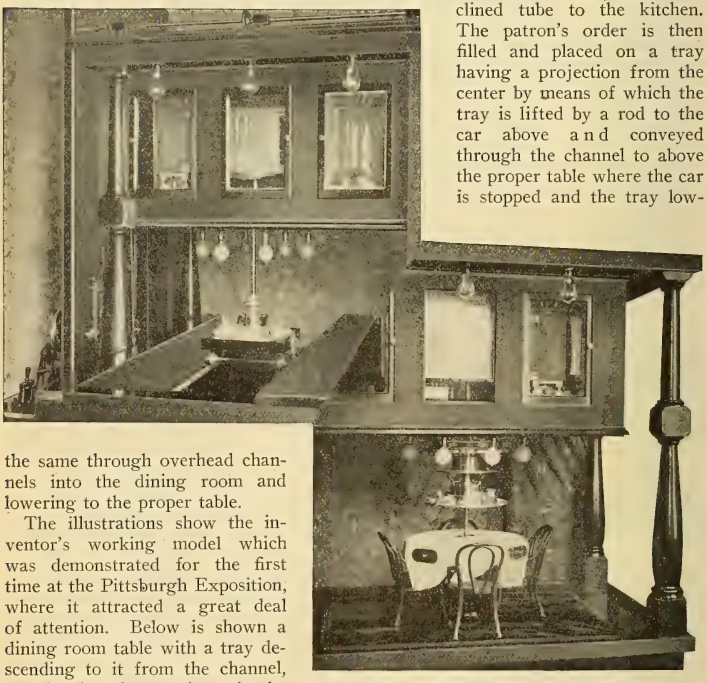
A decided novelty in the matter of signaling passenger elevators to stop at floors where passengers are waiting is to be tried out in one of Chicago's large stores. The "up" and "down" push button is to be discarded and instead an electrical contact mat will be laid in front of each elevator doorway on every floor. The matting, which can be purchased of electrical supply houses, is constructed so that when a person steps upon it at any point an electrical circuit is closed, just as when a push button is pressed.

An Automatic Table Waiter

An automatic serving system for restaurants and hotel dining rooms has been invented recently by James Doyle, of Pittsburgh, who is a colored man, and was formerly a waiter. In general the system involves electrically operated appliances for picking up a tray or several trays of food from the kitchen, carrying the same through overhead channels into the dining room and lowering to the proper table.

The illustrations show the inventor's working model which was demonstrated for the first time at the Pittsburgh Exposition, where it attracted a great deal of attention. Below is shown a dining room table with a tray descending to it from the channel, and in the picture above is the kitchen with a tray in position for being lifted to a car which automatically conveys the tray to the desired table. The motive power is furnished by a small motor not shown in the illustration; for a full sized car in a regular installation a one-fourth horse-power motor is sufficiently powerful, so that comparatively little current is consumed.

The actual operation of the system is like this. On entering a dining room equipped with the automatic serving system the patron checks off his order on the menu slip, encloses it in a hollow ball bearing the number of his table and places the ball in an opening below the table—the ball rolls through an inclined tube to the kitchen. The patron's order is then filled and placed on a tray having a projection from the center by means of which the tray is lifted by a rod to the car above and conveyed through the channel to above the proper table where the car is stopped and the tray lowered. The patron then simply turns a handle releasing the tray and the car returns. The system can serve a table in less than a minute on the average.



KITCHEN AND DINING ROOM TERMINALS OF THE AUTOMATIC TABLE WAITER

A system of any size can be operated

from a single switchboard and by one operator. The control is simple and the position of all the cars in service is indicated so that the operator always knows when the destination has been reached and when to lower.

The inventor claims that his invention will revolutionize dining room service by entirely doing away with human waiters and the tips incident to the present system.

Warns the Man Behind

With the growing mania for speed, and at the same time a desire on the part of the rapidly increasing number of automobilists for safety, various warning devices have been patented. The accompanying illustration shows one of these consisting of a metal cabinet containing upon its face panes of glass upon which are printed words indicating to the man behind what the autoist ahead desires to do. If, for example, the latter is going to turn to the right, he pushes a button which lights the electric lamp in the cabinet on the rear of his machine under the glass marked "Turn R" and the man in the rear acts accordingly.

REAR END SIGNAL BOARD FOR AUTOMOBILES

The Electrics of Taste

A distinguished scientist has suggested that wherever a distinctive flavor is formed in the cooking or eating of certain things together the reason why they seem to improve each other is that a certain amount of electrical action is set up between them.

Experiments have been made along this line, wherein there were used the two eatables as elements in a galvanic battery instead of the proverbial copper and zinc, the idea being to ascertain whether a current would be produced. Articles of diet generally eaten together, such as, for instance, raisins and almonds, pepper and salt, tea and sugar, were tried, and in every instance the experimenter, Edwin Smith, found electrical action occurring, a current being produced. He stated as a result of his experiments that "bitters and sweets, pungents and salts, bitters and acids," appear generally to furnish the elements for true voltaic couples.

Among the articles experimented on were the following, the first mentioned element of the couple taking the place, in each instance, of the attacked element, or zinc: Raw potato and lemon juice, tea and sugar, nutmeg and sugar, horseradish and table salt, onion and beet, vanilla and sugar, starch and iodine.

Temperature of the Arc

Recent determinations, by various methods, of the temperature of the electric arc, gives 3,500° C., or say, 6,300° F., as the most probable average value. This is the greatest temperature that has yet been artificially produced.

In the Copper Country

By GEO. F. WORTS

LOADED MAN-CAR READY FOR THE MILE PLUNGE INTO THE EARTH. IF THE CABLE SHOULD BREAK, THE CAR WOULD STRIKE THE BOTTOM TRAVELING AT THE RATE OF OVER FOUR MILES A MINUTE

The man-car, with its 30 odd occupants, slackened from a sickening, lightning like drop to a stand-still, and the miners, murkily illumined by the flickering oil flames, clambered out into the open tunnel and stumbled off into the enveloping darkness to their stations.

A mile above them—through the hole burrowed at a sharp angle into the rich metallic veins—was daylight.

Under the pine clad hills of the northern peninsula of Michigan, which juts out into the sparkling waters of Lake Superior, lies the metal which gives to this locality its picturesque name—The Copper Country.

Here the highest priced copper in the world is mined and melted into ingots.

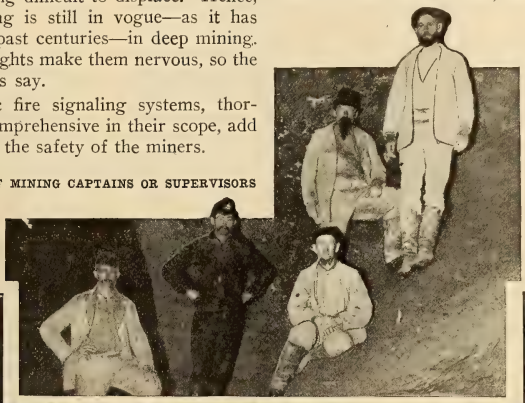
From rumbling depths, thousands of feet below the openings in the hills, tons upon tons of broken rock, bearing the metal so precious to all things electrical, comes in a never ending stream to the black maws of crushers at the surface.

Experienced miners—true denizens of the underworld—drill and blast and tear at the wealth bearing veins, extending their labyrinth of tunnels in all directions in their effort to meet the enormous demand for the "electrical metal," as copper can truthfully be called.

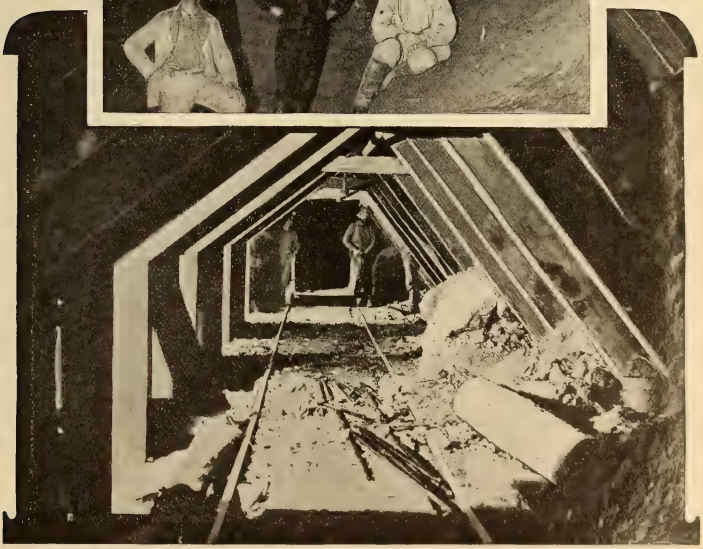
Electric power is utilized in the mines to a large extent, although archaic methods, firmly established by time worn use, are proving difficult to displace. Hence, oil lighting is still in vogue—as it has been for past centuries—in deep mining. Electric lights make them nervous, so the old miners say.

Electric fire signaling systems, thoroughly comprehensive in their scope, add greatly to the safety of the miners.

Electro-pneumatic drills are slowly superseding the straight compressed air type, although, it is claimed, the latter afford a simple means of ventilating the tunnels, bringing the air as they do from a greater distance. In this connection, it is of interest to know that even during the cold winter months when the temperature of the outside air sinks to many degrees below zero, half naked "trammers" at the mine bottom, toil and sweat



A GROUP OF MINING CAPTAINS OR SUPERVISORS



THE ELEMENT OF DANGER—MANY OF THE TUNNELS MUST BE HEAVILY TIMBERED

in an atmosphere which is often over 100° F.

One of the most important electric motor applications in the mines is that of pumping out the drainage water, which everlastingly seeps from the rock and may, at any time, reach dangerous proportions. Pulsing with life like insistency in their tremendous task of ridding the tunnels of water, thousands of feet below the surface, the electric pumps work untiringly that the grimy toilers may drill and blast without interruption in their work.

Electric locomotives, for hauling the broken rock on the various levels, are in extensive use; thereby dispensing with the most irksome of mining tasks—hand tramming. Electric hoists, for lifting the copper rock to the surface, are constantly replacing steam apparatus.

In the words of the electrical superintendent: "All hoisting will be done eventually by electricity. In fact, the possible uses for electricity in deep mining practice are just beginning to become known. In the near future, all mining apparatus will be electrically driven."

A matter of unusual interest in connection with the hoisting apparatus is the heavy steel cable used—thousands of feet in length—to raise and lower the cars. This cable costs approximately one dollar a foot and, in some instances, lengths as great as 16,000 feet are used. When one stops to consider that this cable, from wear, may be discarded in six or seven months, a slight idea may be gained of the enormous upkeep expense of a deep mine.

Arriving at the top of the ground in small cars, or "skips," the rock containing masses of native copper, passes through crushers and thence by rail is transported to the stamping mills.

Here iron and steel mortars and pestles of gigantic size, mounted upon concrete beds of countless tons, and actuated at a high steam pressure, receive through wooden chutes emanating from deep bins, the lumps of copper rock and pound them into fine particles.

So tremendous are the blows of these mighty hammers that conversation is entirely out of the question, and the building, regardless of its especially rigid construction, shakes from foundation to roof; to such an extent, in fact, that special incandescent lamps of low voltage, and having unusually thick filaments, are required successfully to withstand the vibration.

Leaving the three-story-high steam stamps, the intermingled copper and rock is separated by a series of electrically operated machines, embodying an elaboration of the pan principle utilized by the pioneer gold miner—a simple matter of gravitation—the metal settling and the fine sand washing away.

The final and most interesting step in the process involves a slanting, rectangular table with wooden strips, or riffles, over half the surface. The sand washes over these irregularities and the copper, due to a left-to-right vibration of the table, is shaken to the lower end and into tanks.

Another application of a well known physical law in the separation of copper from rock, occurs in a large, whirling bowl, known as the sand wheel. The finely ground particles are loaded into the sand wheel, and it is revolved at a rapid speed. Due to centrifugal force, the copper is thrown towards the circumference and the sand, being lighter, remains near the axis.

And now we come to the vital process in the purifying of a metal surpassed only by one other in world wide utility, a metal which was known and mined and used thousands of years before the beginning of history and a metal whose own history is more fascinating and thrilling than the most exciting romance.

The scene in the furnace room of a copper smelter is one of confusion, well ordered. The roar and hiss of compressed air; the clank and clatter of steel upon steel and the softer ringing thud of bright red copper bars; the hurrying, sure footed flight of half naked

men holding blazing ladles aloft from furnace to mold, illumined by the blinding glare of the molten metal. All this combining of the forces of Nature and Man was bewildering.

Above the din, the foreman explained:

"The copper, 45,000 pounds to a charge, is placed in a large furnace and the temperature maintained at a white heat for half a day or longer. During this time the remaining sand, which has still clung to the metal, melts and floats to the surface and is drawn off as a slag.

"Most chemical impurities are removed by oxidation, forcing compressed air upwards through the molten mass."

PANNING COPPER ON A LARGE SCALE
DULLED DRILLS ARE HERE SHARPENED AT THE RATE OF ONE EVERY TWELVE SECONDS

Above the voice of our guide, and completely overwhelming all other sounds, comes a penetrating explosion, followed by a fiery shower of sparks throughout one portion of the large room.

"Some one poured metal into a wet mold," he explained, and continued:

"The average electrical worker would be greatly surprised to know the effects of impurities upon the electrical conductivity of copper. One per cent of sulphur or carbon lowers the current carrying ability over one per cent. The same amount of phosphorous has an effect just 50 times as great. One part of arsenic in 1000 of copper; that is, one one-thousandth of a per cent, lowers the value of copper for electrical uses over one per cent.

"Refined copper attains—it *must* attain—a purity of at least 99.89 per cent. If silver or arsenic is present the metal is cast into thick sheets and the silver and copper recovered separately by electrolysis."

A large, low lying machine, having odd semblance to a gigantic spider, receives molten copper from a furnace and turns out ingots at the amazing rate of 100,000 pounds an hour—a fact which is causing the entire copper smelting industry of this country to revolutionize and concentrate.

Not only does this queer machine resemble in appearance a mammoth spider of many legs, but it also performs an analogous function, weaving, as it does, the first strands of a mighty copper web which enwraps and holds the entire world for a captive.

One man seated at the center amidst an imposing array of levers and controllers operates the mechanism. An

electric fan perched a foot from his head continually blows full strength upon him, for his job is a hot one.

A livid, scintillating stream of liquid copper gushes from a vent in the furnace wall and flows through iron channels into the molds arranged on the circumference of the great wheel. Square bars, later to be rolled and drawn into wire, are being cast.

In the above ground workings of the Michigan copper mines electricity enters as a prime factor. The first commercial arc lighting system in the United States was here installed in 1878. It comprised an imported generator and 20 lamps. The only prior arc lighting on this side of the water consisted of a similar set shown at the Philadelphia Exposition in 1876 and one installed at

THIS ODD MACHINE RESEMBLES A MAMMOTH SPIDER. LIVID STREAMS OF COPPER FLOW FROM THE LADLE TO THE MOLDS, AS IT SLOWLY REVOLVES

When the wheel has made a half revolution the molds are suddenly tilted and the red-hot copper ingots plunged into cold water.

The relative speed of the Walker automatic casting machine—the invention of Professor Walker of Columbia University—and the traditional hand ladle method is conclusively shown by the following figures:

By hand, 5 men, 6 hours.... 25,000 lbs.
Machine, 1 man, 1 hour.....100,000 lbs.

The color of molten copper defies description. From a beautiful sea green in the cauldron, it flows into the ladle wavering between green and a pale, opalescent pink. It reaches the molds in a glorious golden stream and cools to a ruddy hue when thrust under water.

Cornell University in the same year.

Huge generators of the latest design spin quietly in their work of supplying current to hundreds of motors by day and a myriad of twinkling lamps by night.

One of the most noteworthy applications of the electric current in the mining industry of this section, occurs in the Calumet and Hecla drill shop—the largest project of its nature ever attempted.

Several massive machines receive the hexagonal drill blanks, heat and reheat them, mold and hammer and fashion their heads into peculiarly shaped cutting edges, performing the work of many hands in an inconceivably short time.

In the same manner dulled drills, red

from their grinding contact with the copper, are re-sharpened. Five drills a minute, or approximately 3,000 a day, is the capacity of one machine.

Arriving from the mines in little cars, the dull drills are unloaded by an electric crane and reach the sharpener by means of an endless transmission belt.

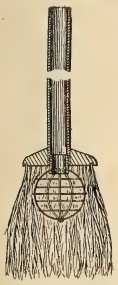
As the hexagon rods approach the machine, they are ingeniously lifted from the belt by steel "hands" and placed crosswise upon a slowly moving chain. First, they pass under a terrific blast flame of vaporized oil; thence, through a succession of pneumatic hammers, back upon the lower or returning part of the transmission belt, and to the mines.

Besides the electrical operation of mines and mills, current is also supplied to the various machine shops and foundries, as practically all of the machinery in them is electrically driven.

A novel addition to the electrical equipment of twelve of the mining shafts was the recent installation of searchlights on the dashboards of the man-cars. The white beam is invaluable in detecting flaws in roof and rail, and proves a source of considerable entertainment to the visitor to whom the violent downward plunge formerly held such terrifying thrills.

Duster for Vacuum Cleaners

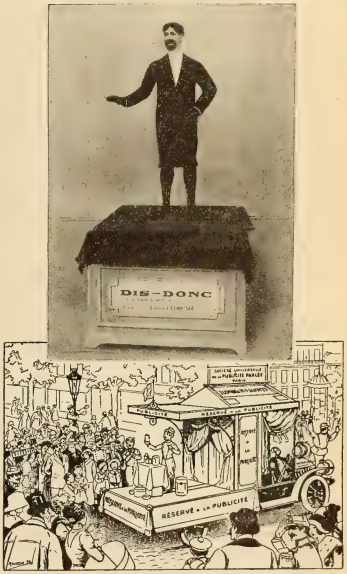
A combination of the old fashioned feather duster and the most modern device, the vacuum cleaner tool, is shown in the illustration. The duster is intended for attachment to a vacuum cleaner and for use especially in dusting fragile china or similar articles. The feathers together with the suction will more thoroughly dust the articles to which it is applied than the ordinary tool, is the idea of the inventor, Charles L. Eichele, Pittsburgh, Pennsylvania.



DUSTER FOR VACUUM CLEANERS

The Speaking Automaton

The new Forcade speaking automaton is a French invention and is quite an improvement over what is already used. It is intended for advertising purposes and the like, so as to attract the attention of the public. It is of life size and the base contains an electric mechanism



IT HAS A MOST LIFELIKE APPEARANCE

working together with a phonograph. What is novel about the device is that it has a most lifelike appearance, and there are no less than fourteen animated parts, including the eyelids, eyes, mouth, head, forearm and arm, hands and fingers. By combining the different positions which all these parts can take, the figure has no less than 5,600 attitudes given by the mechanism. A double phonograph in the base can give both spoken parts and singing in turn. When placed in front of a store or just inside,

it can be dressed as a "runner-in" to proclaim the merits of the wares, or as a bill distributer. Using a table in front, carrying food products or any kind of goods, the figure can be dressed as a cook, chocolate girl, and the like, and is sure to attract a large crowd. Political candidates can also multiply themselves, and the phonograph faithfully gives their ideas in a loud voice without any fatigue. At night the figure can be brilliantly lighted by electric light and can be mounted along with suitable electric flash signs.

The First Carborundum Furnace

Long ago man found it possible to produce crystals of great hardness by the application of terrific heat. This high temperature is only available for practical purposes in the electric arc. However, without the cheap production of electricity the use of the electric arc furnace

THE FIRST CARBORUNDUM FURNACE

in the industries is prohibitive from the economic standpoint. With the harnessing of Niagara Falls the manufacture of carborundum on a large scale was born. By mixing coke, salt, silica and sawdust in proper proportions, and placing the mixture into a long pile with a huge electrode at each end the application of electricity in the form of a huge electric arc produces wonderfully hard crystals called carborundum.

These crystals, which are excelled in hardness only by the diamond, are reduced to various degrees of fineness, and from these are produced all grades of grinding wheels, carborundum paper and cloth.

The first carborundum furnace built by the great company at Niagara Falls is shown in the illustration. This is preserved and stands among the many modern buildings which shelter this great industry. The electric furnace as used today contains huge water cooled electrodes weighing hundreds of pounds, and consume as high as 2,700 electrical horsepower. The voltage used varies from 100 to 200 volts, making a current capacity for these furnaces of 10,000 to 20,000 amperes. More than a score of these furnaces are in operation today, and the first furnace shown in the illustration stands near-by a silent testimonial of the growth of this industry.

Moving Pictures for the Blind

There is a device, invented by Doctor Dussaud, of Paris, whereby blind persons may experience the illusion of moving objects as people with sight do an illuminated screen. The apparatus consists of a machine operated by electricity which causes a series of reliefs, representing trees, birds, or other objects, to pass rapidly under the fingers. The reliefs are so graduated that the delicate sense of touch possessed by the blind translates their variations into apparent movements of the objects which are represented.

Doctor Dussaud employs the apparatus mainly for educational purposes. He has also devised a system of electric vibrations for conveying to the deaf an impression of musical rhythm.

Motors in the Quarrying of Sandstone

An exceptionally fine grade of sandstone for paving and building blocks, having a fine gritty surface free from the slippery ingredients, mica and feldspar, has been located at Stevens Point, Wis. In quarrying this standstone a scraper and shovel gang strip off the loose, disintegrated stone and clay which covers the standstone to a depth of ten feet or more, drilling holes and loosening with charges of dynamite. Next below this is found a loose layer of seamy rock which is pried off with a crowbar and is used in rubble building stone work. This exposes the sandstone proper, into which fourteen foot holes, two inches in diameter and ten feet apart are sunk into the ledge, about seven feet back from the face, by means of an electric air drill.

A DUPLEX AIR PULSATOR DRIVEN BY A FIVE HORSEPOWER MOTOR OPERATES THE DRILL

THE PLUG DRILL WILL MAKE A HOLE FOUR INCHES DEEP AND ONE INCH IN DIAMETER IN ABOUT THREE MINUTES

This drill is mounted on a tripod and driven by the pulsations of compressed air, created by a duplex air pulsator, which in turn is operated by a five horsepower motor.

The pulsator has an unique feature, namely that it has no intake or discharge valves—the air in it is never exhausted but is used over and over again, playing back and forth in a closed circuit. Two short lengths of hose connect pulsator and drill, each of which run from a pulsator cylinder to one end of the drill cylinder—one serving as an admission while the other serves as a return. The air simply acts as a transmitting agent; an unwearing, unbreakable spring or cushion between the pulsator and drill, transmitting the energy of the motor to the point of impact with the stone.

These fourteen foot holes are loaded with a charge of black powder, just enough in fact to loosen and throw the stone over in large chunks but not enough to break it into fine pieces. Blocks weigh-

ing several tons are thus loosened and the next operation is to drill them across the center with a plug drill operated by an electric motor. This drill is held in the hand of the workman and will plug a hole four inches deep and one inch in diameter in about three minutes. A line of these holes is made across the block generally at right angles to the grain of the stone, a single-bit drill point being used for this purpose. Into these holes are inserted "plugs and feathers," or adjustable wedges; a few blows with a sledge hammer on the plugs cause the stone to break squarely in a straight line, thus dividing it. This process of division goes on until chunks approximately two feet square are obtained; these are drawn by a horse to the different block cutters located in various parts of the quarry, who split and resplit the blocks down to the proper sizes by means of 24 pound mells or sledges, with a sharp edge.

Sandstone from the Stevens Point quarry has been found by actual test to have a crushing strength as great as that of granite, running as high as 23,000 pounds per square inch and in composition is practically pure quartz.

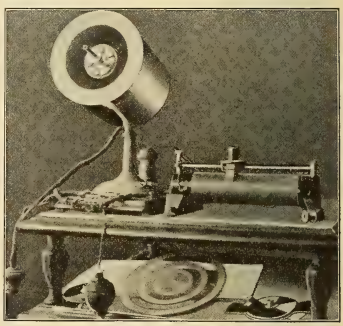
An Artificial Aurora

In a lecture delivered not long ago before the Royal Society, Sir William Ramsey showed an experimental proof of the electrical nature of the northern lights. Between poles of a powerful electro-magnet he suspended an exhausted glass globe, containing at the top a metallic ring. An alternating current discharged through the ring in the globe produced an annular glow, and when a current was sent through the coils of the electro-magnet the glow was deflected downward in streamers resembling those of the Aurora Borealis.

The spectrum of the natural aurora shows the presence of krypton, and in this Ramsey's experiment krypton was produced in the discharge through the rarefied air within the globe.

A Color Blending Top

An electric color top designed by P. Dosne and made by Poulenc Brothers, Paris, France, is designed to aid in the blending and matching of colors. It is well known that almost any shade or tint may be obtained by properly mixing the three primary colors, red, yellow and blue. The top is provided with three color disks, each representing a primary color. These disks are mounted upon the shaft



COLOR BLENDING TOP

so that their segments form a circle. They are also adjustable so that any proportionate area of the various segments is obtainable. When rotated very rapidly by the motor which operates the top, the colors of the segments blend so as to give the disk a certain definite shade or tint—this is a simple and easily performed experiment in physics.

Suppose a printer, for instance, wishes to mix his inks so as to match the color proof of a cut or sample of printing. Instead of dabbling with the inks to get the right effect he would adjust the disks of the top until when whirled rapidly they would present the same shade as the sample—this could be accomplished after a few trials. Then, stopping the top, he would note from a scale, the proportions of the three primary colors shown by the exposed segments of their respective disks, and mix his inks accordingly.

Electric Gondola

At his beautiful home in the Thousand Islands an artistic 40-foot electric gondola has been utilized for pleasure service by Commodore F. G. Bourne, of the New York Yacht Club, and the electric boat has been greatly admired. This Venetian gondola was built at Bayonne, N. J., and is equipped with an electric motor and storage batteries, giving a normal speed of 7½ miles an hour, with a maximum speed of nine miles an hour.

Constructed of Indian teak and African mahogany, the entire exterior of the felsi, or cabin, is hand carved, while the interior is luxuriously upholstered, even the ceiling being paneled handsomely in leather.

It is understood that Commodore Bourne had intended to have this boat built in Venice, but on the assurance it could be constructed in this country to his satisfaction, he directed that it be built here.

In order that the gondola should be built in strict accordance with all the technical traditions, which have been handed down from the time of the Doges, some dating back to the Eighth Century, an exhaustive research was made of all that has been written pertaining to these ancient craft, an examination of old prints being made in order not to offend any of these traditions.

For instance, the ferri, or irons, which decorate the bow and stern, are exact reproductions of those from a boat built in the Eleventh Century and are of polished nickel steel. The highly ornamented rowlocks or forcoles, represent sea horses and are bronze castings on carved teak bases.

AN ELECTRIC VENETIAN GONDOLA AT THE THOUSAND ISLANDS

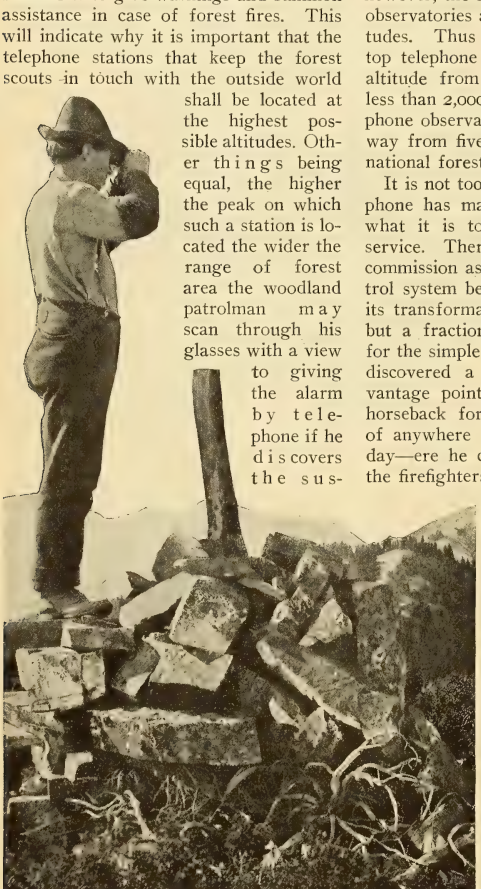
The source of electric motive power has been skillfully concealed so that the boat glides silently along as though propelled by some ghostly gondolier.

Lamp Filaments

Tungsten filaments for electric lamps, the price of which has been reduced within the past year or so by reason of improvements in methods of manufacture, now vary, it is said, from .001 to .013 of an inch in diameter, but filaments as small as .0008 of an inch in diameter can be made commercially. Comparison with threads of glass drawn down to approximately the same diameter shows that the glass has almost three times the ultimate strength of the tungsten filaments, but the filaments are much more flexible than the glass, which gives about 60 per cent less deflection under the same load.

Telephone Stations of the U. S. Forest Service

The primary purpose of the Federal forestry bureau in maintaining telephone stations is to give warnings and summon assistance in case of forest fires. This will indicate why it is important that the telephone stations that keep the forest scouts in touch with the outside world shall be located at the highest possible altitudes. Other things being equal, the higher the peak on which such a station is located the wider the range of forest area the woodland patrolman may scan through his glasses with a view to giving the alarm by telephone if he discovers the suspicious smoke rising among the trees at any point. It is not meant to convey, however, the impression that all of these observatories are located at extreme altitudes. Thus we have these mountain-top telephone stations ranging down in altitude from 11,000 or 12,000 feet to less than 2,000 feet. The number of telephone observatory stations varies all the way from five to 20 in each of our 150 national forests.



UNITED STATES FOREST RANGER MAKING OBSERVATIONS PRELIMINARY TO TELEPHONING A REPORT

It is not too much to say that the telephone has made the forest observatory what it is today in our governmental service. There were lookout stations in commission as adjuncts of the forest patrol system before the telephone worked its transformation, but they represented but a fraction of the present efficiency for the simple reason that when a ranger discovered a forest fire from such a vantage point he had to walk or ride horseback for miles—involving a delay of anywhere from an hour to a whole day—ere he could sound the alarm for the firefighters that he now gives literally at a moment's notice by telephone. Heliograph signaling, the only other form of communication which has ever even suggested itself in this connection, has been tried by the Forest Service with varying degrees of success, but the fact that sunlight is required and that smoke, which is inevitable throughout the entire region where a forest fire is raging, puts a ban on heliographing has served to give the telephone a monopoly of the field in these latter days. Now the officials in charge of our great national for-

ests are eagerly awaiting the higher development of wireless telephony to the point of general commercial practicability.

In many sections of Uncle Sam's forest domains the climatic and natural conditions are such that no effort is made to keep the telephone lines to the lookout stations in commission during the winter. However, with the approach of the forest fire season (which may be said to extend from spring until late autumn) linemen are sent out and the wire system is put in condition for business. Thereafter tests are made at frequent intervals to ascertain that the line is in working condition and in some localities where the menaces are many, and where any interruption to communication might be especially serious, regularly organized patrols are constantly traversing the phone routes in order to keep the wires in perfect condition.

An interesting development of the government's telephonic supervision of our public forests and national parks is found in the erection at strategic points of lookout towers—elevated platforms equipped with maps and range finding apparatus for locating distant forest fires and with one or more telephone instruments for sending broadcast news of the discovery of the fire.

Many of these lookout towers for fire watching are of wooden construction, some of them having been erected at a cost as low as $15, but lately Uncle Sam has taken an important advance step and has constructed several iron or steel telephone towers. Some of these lately completed towers in the Ozark National Forest are each 64 feet in height and have a twelve-foot spread at the ground. They are constructed of galvanized iron and each post has a fourteen-inch anchor set five feet in the ground. The tower platform at the top is five feet square and is capable of sustaining a weight of 2,500 pounds. Here, duly protected against the weather, is the all important telephone instrument and, as a precaution against damage by trespassers, a padlock is attached to the trap door opening to the platform.

Such precaution is necessary, of course, only where a tower or other lookout station is simply visited by a patrolling ranger several times a day as he reaches the point on his regular rounds. In the case of many stations, particularly those located on lofty peaks, the ranger on duty occupies a camp or cabin at the observatory site and, being constantly on duty, is enabled to telephone at frequent intervals. In the case of all telephone stations it is required that rangers shall report by telephone at stated intervals as evidence that they are on the job, no matter whether or not they have news of forest conditions. The telephone is yielding yet another important service to the Federal forestry institution in affording a means of calling in rangers and other employees for work at points other than their regular stations, and from the regular stations during rainy periods, when there is no danger of fire.

While the watcher for forest fires has, of course, not the benefit of anything approximating a telephone "central," he has, in most instances, two chances instead of one of sounding a warning at any hour of the day or night. His tower or mountain top terminal is connected not only with the office of the forestry official in charge of the particular district in which his station is located, but also with the office of the supervisor who has jurisdiction over a large forest area. If one cannot be reached it is probable that the other can. Most of the forest telephone lines are of the overhead variety, trees being used as supports for the wire, but in some instances, particularly in emergencies, wire is laid on the ground and for this class of work the preference is for about a No. 20 B. & S. gauge copper wire with a light insulation, similar to that used by the U. S. Signal Corps and weighing not over 25 pounds to the mile. Resistance is low enough to render it serviceable up to 75 to 80 miles, either

1. STEEL LOOKOUT AND TELEPHONE TOWER IN THE FOREST REGION OF ARKANSAS

2. TELEPHONE STATION FOR THE USE OF FOREST RANGERS IN ARIZONA

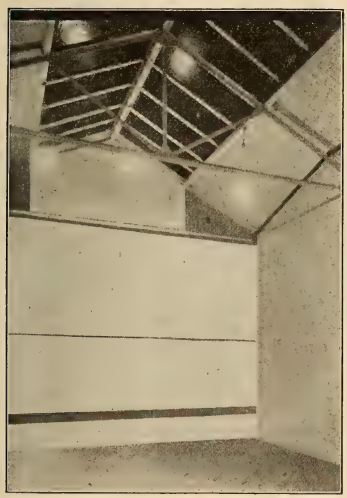
3. TELEPHONE STATION IN THE WILDS—ERECTED AT A COST OF $15.00

4. UNCLE SAM'S LOOKOUT AND TELEPHONE TOWER NEAR THE GRAND CANYON OF THE COLORADO

as a separate grounded system or when attached to a galvanized iron pole line. Such equipment can be used during actual fire fighting as well as in reporting conditions in an emergency.

Special Illumination of Rackets Courts

In England the use of artificial light in order to enable games to be played at night time is becoming quite a feature. Perhaps the most simple case of artificial



AN ENGLISH RACKETS COURT AND METHOD OF ILLUMINATION

lighting for athletics is the racket courts which are springing up in London. They can be built and lighted quite cheaply. The illustration shows a court of this kind illuminated by a series of Holophane reflector bowls and tungsten lamps. The game is played within white walls and with a small black ball. A very even illumination is necessary and it is stated that in this case the artificial arrangements were better than daylight. The court is 30 feet long, 21 feet broad and 15 feet high. The consumption of electricity is only about one-third of a unit per hour, costing a little more than one penny.

Electrifying the Railroads of a Whole Country

Switzerland has set for itself the task of electrifying every railroad within its borders. A commission recently appointed for the purpose has brought in a report recommending a 1,500 volt, single phase system. After a thorough investigation, experiments made to determine the mileage and cost show that the entire Swiss system can be converted at a cost of something like $14,000,000. There are some 1,700 miles of road, and the work will be started at once on the St. Gotthard tunnel route. Here are found the steepest grades and longest tunnels. One of the latter undercuts the mountains for nine miles. The commission has reported that the cost of operating a railroad by electricity, even at its worst, will be over ten per cent lower than if run by steam power. Coal in Switzerland is a most serious problem, since the country produces none. Power, however, is available everywhere from the numerous mountain streams and cascades, all owned by the government.

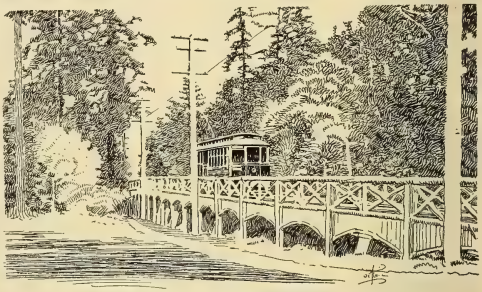
Electrical Music

An interesting experiment may be made, with the aid of electricity, in a vacuum tube. When a continuous current is sent through such a tube, matters being adjusted so that the current is only just able to pass, the current becomes periodic, and the cathode, being set into vibration, gives forth a musical note. The vibrations are ascribed to the periodical attractions exercised by the electric charges on the walls of the tube.

Style in Trolley Construction

Seattle is fast acquiring a reputation as a city of beautiful parks and boulevards. She has more parks and bigger parks than any other city of her size and age in the United States. Seattle might be said to be park crazy, and the electric railway people, too, naturally fell in line with the movement, with rustic bridges, rustic stations, rustic rails, rustic employees, and everything else rustic that goes with a rustically finished park.

Woodland Park is Seattle's biggest and best. It is not a man made park. It is mostly just as Nature made it, and the section of land it contains right in the city's midst is covered with a heavy forest in which giant trees of every description stand. There are lawn plots by the acre scattered everywhere for tennis courts, ball games, drives and promenades, and there is a zoo well worth going miles to see. But the Seattle electric company made itself solid with the park management when it built its pretty rustic bridge and trestle through the park, thereby making the line a thing of beauty instead of a badge of man's handiwork with a maul and railroad spikes.



A RUSTIC TROLLEY BRIDGE IN SEATTLE

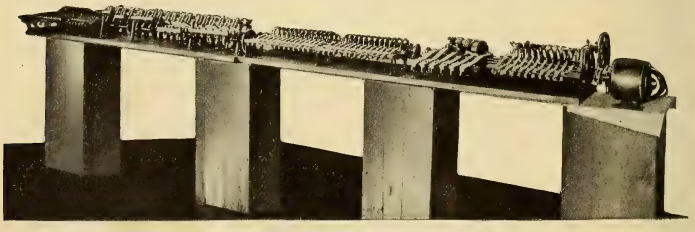
The Largest Sign Flasher

The largest sign flasher ever constructed is shown in the accompanying illustration, the photograph for which was taken just before shipment to New York City, where it will be used to operate a large sign on Broadway.

The flasher is run by a ¼ horsepower, 110 volt, alternating current, slow speed motor, operating on the same circuit as the lights which it controls.

The cycle of the sign is 50 seconds, the motor is belted to the flasher from a small to a large pulley, and further reduction in speed is obtained by reduction gears.

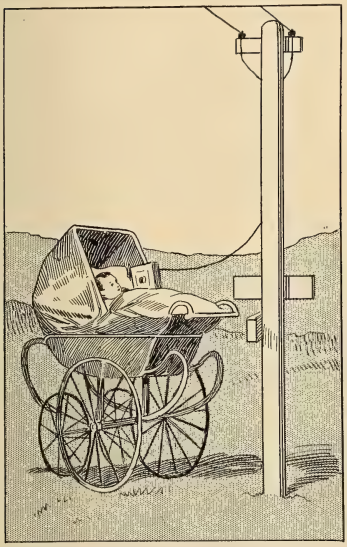
The flasher controls 74 circuits; that is, there are 74 changes in the cycle of the sign; of course, on some of these circuits there is a large number of lights which flash on at the same time.



FLASHER FOR A BROADWAY SIGN

Tending Baby by Telephone

In the October issue of POPULAR ELECTRICITY MAGAZINE, page 547, is a picture of the Platte Fougere Lighthouse, Guernsey, and some of its electrical equipment, but not all. The accompanying illustration shows the unique arrangement used at the station to aid the keeper's wife in caring for the baby while it



TENDING BABY BY TELEPHONE

takes a nap in its carriage out in the open air.

A cigar box containing a telephone transmitter and a clock are placed in the carriage close to the baby's head. Wires run from the transmitter to a telephone receiver in the house. Now and then as the mother goes about her work she picks up the receiver and listens to hear if the youngster is entering any audible protests. The ticking of the clock can always be heard and is an assurance that the line is in working order.

Profuse Light Pays the Jeweler

By rearranging his electric lights and using white paraffin shades for show window and interior display, Hugo Block, a Chicago jeweler, has increased his business fifteen per cent in four months. He handles a large quantity of imitation diamonds, and was worried because of the fact that by his old arrangement of lights the stones showed yellow instead of the desired white, and prospective customers became dubious.

The store has a 12½ foot front and 25 foot depth. Because of the brilliancy of the stones the casual pedestrian could hardly pass without being attracted by the unique window. There are twelve 60 watt tungsten drop lights with paraffin shades in the show window. Suspended from the top of the window over the glass is a white curtain like cloth, and the twelve lights are concealed behind this. Each imitation diamond is invested with the same white luster that characterizes the genuine, and the only intimation the gazer would have that the stone is not genuine is the price tab attached. The lights are so arranged that their full power is concentrated on the stones that it is desired to give the most prominence.

Arranged about the show cases inside the store are 24, 25 watt tungsten lights with paraffin shades, sixteen of these being drop lights. There are also two chandeliers suspended from the ceiling near the entrance, each holding four 60 watt tungsten lights. So profuse is the lighting, in fact, that the interior of the tiny store has almost the appearance of an electric bath cabinet.

"I had been displeased for a long time with my window display, because the lights caused the imitation diamonds to look yellow instead of white," said Mr. Block. "This situation caused sales to be slow, and I decided that I must remedy conditions. I consulted with the electric light people, and they suggested that I use paraffin shades and also have the lights arranged behind a curtain so that

the full force could be focused on any part of the display I might wish to give prominence. Within one week after the imitation jewelry commenced to show the white luster of the real diamond business began to increase until today it is fifteen per cent better."

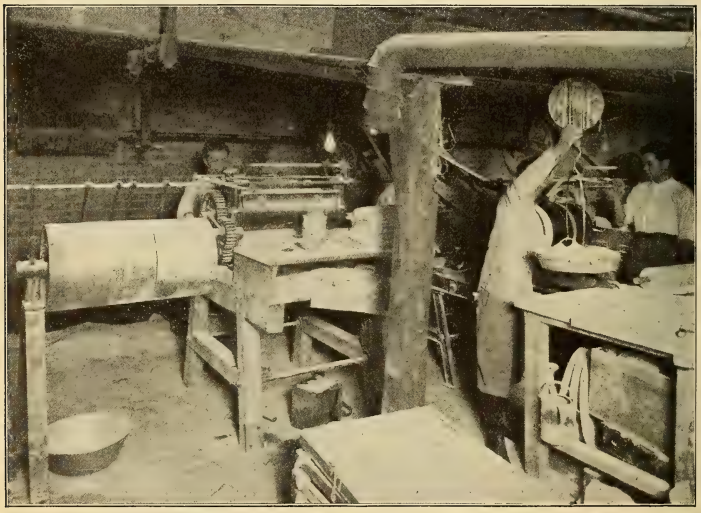
The Chinese Noodle Makers

The industry of noodle making is quite a flourishing one in the Chinese colony bounded by Mott and Pell streets and the Bowery, on the lower East Side of New York. Tons of the stringy delicacy so much relished by Germans and German-Americans are manufactured daily by these sons of the Orient in the dingy basements of Chinatown.

Moreover, these noodle makers are exceptional, as Chinese go. They are progressive to the extent of attempting to manufacture the noodles with the aid of electricity, and the result is that now the output of each tiny basement factory has been trebled. The absence of fire and odor appealed to the cautious Celestials, and immediately after the first factory was equipped other factories arranged for electric service. The result is that now, with few exceptions, the noodle factories on the East Side are operated by electric power.

But in spite of the fact that the Chinamen of New York have been familiar with electricity, electric lights and electrically operated machinery for some time, they are still wary about provoking the Evil God of the Wire to wrath. In several of the noodle factories of Chinatown it has been noted that some one of the more superstitious employees takes particular pains each night to cover up the motor and the switchboard with gaudy blankets so that "they will not catch cold." The employees are very much afraid to take any chances with the erratic temper of the enigma called electricity.

In fact, some of the men refuse to



THESE CHINESE NOODLE MAKERS ARE PROGRESSIVE

touch the switch handles at all and those who do, often poke them over with a stick or broomhandle, so that they can be at a safe distance if the Monster should take it in his head to hiss and sputter at them.

One of the first of the noodle manufacturing concerns to use electricity for the operations of their machines was the Mon Chong Tai Company on Mott Street. The factory is in the basement under the salesroom of the company, and although in very cramped quarters the Mongolian workmen manage to turn out nearly three tons of noodles each day.

The Mon Chong Tai factory is as large as the average Chinatown noodle factory, being equipped with two heavy rolling mills and one cutting machine, besides an automatic dough mixer. The foreman of the factory is a well educated Chinaman and consequently he has very little superstition about electric power, but the employes under him hold various and weird opinions as to the damage that the God of the Wire might do were he to be offended.

The Chinese noodle manufacturer finds very little trouble in disposing of his output. The only thing he has to be careful about is to see that his clerks do not mix up the labels. When a shipment is made to a German-American grocer the cases are carefully labeled "Noodles," and when a Chinese restaurant proprietor is the purchaser the package bears the Chinese characters which translated would mean "Yakaman," for the two are identical.

The process of noodle making is very simple. The dough is composed of nothing more than flour, water, eggs and salt. It is cooked for a very short time in a huge boiler and then dumped into the mixing machines to be properly kneaded.

Before machines were introduced the noodle makers kneaded the dough in a huge wooden tub and very often if the quantity was large the kneaders were not adverse to getting into the tub with bared feet. That helped matters considerably and seemed to be a time saving method. But with the advent of the mechanical dough mixer and the subsequent enlightenment of the Chinese that method was abandoned.

In the olden days the dough, after it had been kneaded, was rolled with huge rolling pins into strips as thin as waxed paper and ten or fifteen feet long. But now the rolling machine does that work. The dough is fed through it and comes out into a strip so thin as to be translucent and varying in length from 100 feet to the average length of a city block. As it comes out of the machine it is dusted with powder and rolled onto polished hickory sticks.

As it is kneaded it is unrolled into four or five-foot strips and folded neatly. At that stage is looks very much like a thin felt blanket and far from relishing to the appetite. These folds are fed on a canvas belt through a cutting machine and chopped into strips scarcely an eighth of an inch wide. Then it is piled on huge trays to await the coming of a customer, or an order. It is never packed until the order is forthcoming for some reason or other.

Magnetism and Petroleum

It has been observed that the great Appalachian oil field is the area of the greatest variation of magnetic declination in the United States, and in glancing over a map of the magnetic declination for the whole country, one finds that the irregularities of the compass needle are strongly marked in the principal oil regions. Similar magnetic conditions have been observed in the oil region of the Caucasus. The facts go to bear out the assumption that the great oil deposits are generated from iron carbides. But besides oils thus due to inorganic processes, there are stated to be others which are undoubtedly of organic origin, derived from carbonaceous matter of vegetable or animal origin.

Something Really New—The Magnaphone

Although school has just "let out" and the afternoon is fine, a dozen boys of baseball age are gathered in a library in an upper Broadway apartment house. They are ranged in a circle, facing a corner of the room, straining eager ears and eyes toward a small horn about the size and appearance of those used by the deaf. From the horn comes a voice, proclaiming:

"Ty Cobb fanned out, leaving two men on bases, and two out. Southpaw Binks to the bat."

The boys set up a babel of heated comment, which instantly subsides into tense quiet when the voice in the horn continues:

"Binks hits a bounder to the pitcher. The ball flies home and then gets to first ahead of Binks. New York to the bat."

The strange instrument about which the boys are grouped is called a magnaphone. It is the latest development of telephone principles, put to the fullest use in news and music distribution.

When the baseball bulletins cease a voice announces:

"Barbieri will sing Shubert's 'Serenade,' by special request."

So it varies—music and baseball scores, weather reports and the latest news. At three minute intervals, from noon till midnight, the horn in the corner of the library keeps up a continual chatter.

At present there are nearly 100 such instruments in New York apartments, and the number is increasing. The wires from these various machines lead to a central office. This office can send news service and music to 1,000 subscribers with its present equipment.

In Wilmington, Delaware, a central office for this service has actually over 1,000 subscribers getting this new kind of wire service.

In the New York office the wires all lead to a table on which there are ten disks for graphophone records, and to a single voice transmitter, through which the news bulletins and announcements are sent. In connection with each disk there is a novel kind of transmitter, fitted with a graphophone needle, which operates over the record as usual.

But it is not a sound box, as in the graphophone, which receives the vibrations of the needle as it travels over the record. The sound boxes are all at the other end of the line, perhaps blocks away, possibly miles away. While the record is turning no sound is heard at the machine. In order that the operator may know that the record is playing, he must have one of the receiving horns in the room with him, or he must depend upon the lamps which are cut into the same circuit with the transmitter to tell him that the machine is working.

The little transmitter works a modern miracle in the way of music. The vibrations of the needle are transformed first, not into sound waves, but into electrical waves, which are sent over the wire. At the receiving end they are transformed back into sound waves. The result, maybe years after the human voice threw its melody into the graphophone horn, and certainly miles away from the instrument which is reproducing the song—the result, after all this interval of time and place, is music. This music is capable of constant magnification. It can be so repeated that ten people can hear it. And it can be repeated so that a thousand instruments in as many different places will pour out melody.

One graphophone record, however, is not depended upon for 1,000 wires, if all are listening. The transmitting table having ten disks turned by a single motor and controlled by a single switch, ten records can be played at once in absolute synchronization. It is customary to use an additional record for each 100

subscribers using that particular line.

By jacketing the transmitter with a flow of cold water on the same principle that the steam engine is jacketed, the inventor is enabled to pass through each transmitter, without burning it out, sufficient current to permit connecting in excess of that necessary for 100 wires.

The music is not limited to the graphophone, although that is the principal reliance at present and will probably remain so. But as the service is extended, high class soloists and singers can perform directly before the voice transmitter.

In the meantime many other exten-

TEN DISKS PLAYING THE SAME SELECTION CAN SERVE 1,000 SUBSCRIBERS SIMULTANEOUSLY

The service is not expensive, the present rate being eight dollars a month to each subscriber.

In spite of the value of the music to the sick and the lonely, the news is proving to be the most attractive feature of the service offered by the magnaphone company. It is always ahead of the newspapers on local news. The regular news is bulletined once an hour, but special features have precedence over the announced music schedule.

sions of the serviceableness of this instrument have come. In the first place, it has been installed in the Grand Central Terminal in New York, and with receiving horns at all parts of the station, one announcer is enabled to call out the trains in a voice uniformly distributed. Last summer at the close of the season these instruments were installed in one of the Hudson River boats to Albany for announcing features of the scenery. The United States Navy appreciated the pos-

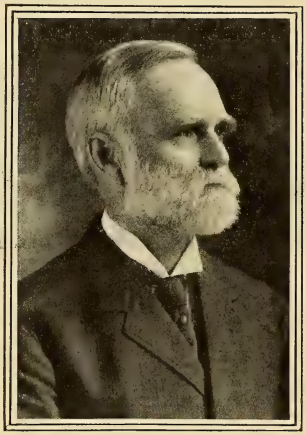
sibility of these instruments on ships. The battleship Utah is now equipped with the magnaphone, and eventually all of the vessels of the navy will be.

The inventor of the magnaphone, George R. Webb, is constantly extending the use of the instrument. When he first produced it, over five years ago, he was heavily interested in various electric light companies, traction companies and telephone lines. At one time he was president of the United Railways of Baltimore, of the electric light company and of the telephone company of that city. He was also head of the Pittsburgh, the Allegheny, the Duquesne and the Wilmington light companies. The magnaphone was simply his relaxation, but now he has given up all other interests to push this one invention. So quiet had been Mr. Webb's work in New York that no notice was taken in the newspapers of the franchise, and of the wonderful field it was opening up. None of them heralded the entrance into their field of an agency certain greatly to influence them, and possibly to prove in some ways an all powerful rival.

The Practical Engineer

By ONWARD BATES, C.E.

Extracts from "Addresses to Engineering Students," edited by Waddell and Harrington, consulting engineers. This is the sixth of a series of similar articles by prominent educators and business men, which will be especially interesting to boys and young men who contemplate following the engineering profession.—Editorial Note.



If I give you a lecture on words, it is not wholly inappropriate under the title of The Practical Engineer. We are not dummies; words are as necessary to us as to others, and in our profession more necessary than in some others. I will not ask if each of you knows his letters, accepting that much without question; but I do question if each of you knows how to spell. If you do, it is more than some practical engineers do. Correct spelling is an accomplishment; a man is frequently underrated just because he has made some mistakes in spelling. It is also a matter of importance, for sometimes the idea one wishes to convey is changed by a mistake in spelling. It is important to know the meaning of words, in order that you may say or write what you mean. How can one expect to write specifications, or draw up contracts, if he does not know what words to use, and what construction can be put upon them when they have been used? In addition to spelling correctly, and using words whose meaning you understand, it is still more essential that you should know how to string them together. Our profession is exact in its nature, and should be precise in its expressions of fact or opinion, written or spoken. There is no occupation in which it is more important to say pre-

cisely what is meant to be said. The engineer's opinions should be expressed with the same regard for accuracy as is used in his mathematical computations.

Can you write a letter? Some engineers cannot. They may write what purports to be a letter, and can perhaps make their correspondent understand the ideas they wish to convey. I do not ask if you can write legibly; that seems to be a lost art, and is not, in these days of typewriters, to be expected. I mean, can you write a letter, stating in clear, distinct, concise and correct language the facts and opinions which you wish to make known to your correspondent? If you cannot, then your education as an engineer is incomplete.

Do you know how to talk? To talk well is a great art. You can please, you can plead, you can instruct, you can command, or you can rebuke, in each case with the right use of words, and the right degree of emphasis, if you can correctly use the English language. Talk, like every other commodity, is valuable not for its quantity, but for its quality.

The command of the English language is a necessity as well as an accomplishment. It is the language of the profession, and it is fast becoming the language of the civilized world.

I have personally felt myself handicapped by fixed ideas, narrow views, and a stubborn purpose of proving myself to be in the right. Is narrowness of mind an inherent quality which leads one to select engineering as his vocation? I reject this query with scorn, and only mention it to dispose of it at once and altogether. It must then be due to his education, and I think the trouble is located in the university. The professors may demolish me for this statement, but I have a right to make it, for I am a member of the National Society for the Promotion of Engineering Education. I am also a member of a National Committee to Consider the Status of Engineering Education.

In the first instance, professors of engineering are usually specialists, and they generally teach their specialties. In a teacher's effort to impart the knowledge of his specialty to the student, the latter forms his opinion of the specialty and is much influenced by the personality of the teacher. If the subject is one for which the student has an aptitude, or liking, it obtains a preference in his mind over other subjects. He becomes more proficient in it and he attaches more importance to it. It is an old saying that it takes nine tailors to make a man, and I suppose it takes at least that many professors to make an engineer.

The young engineer does not, as a rule, grasp the opportunities which are ahead of him. He may have a remote idea that some day he will be a chief engineer, that great works will be under his charge, that important questions will be submitted to him for decision, that he will be called upon to plan great structures and to solve large problems; but just how these honors will come to him he does not know. There are certain qualities of mind which young engineers do not possess, because they have not learned them. One of these is the quality of discrimination; the ability to determine between right and wrong, good and bad; what should be rejected, what is acceptable; and what is to be desired and striven for. In other words, an engineer is not fitted for high position unless he is judicious.

There is no quality so much appreciated by those who have need of your services, and who are in a position to promote your advancement, which is as much valued as the quality of reliability. In past times men have attained distinction as engineers who had no college education, and very little school education of any kind. These same men, however, could not start over and succeed under existing conditions. At the present day it is useless for any one, who has a proper ambition to be among the first in his vocation, to attempt the engineering profession without a university education.

There is one more specification in the charge against the engineers of a narrowness of vision, and it is this, that those of us who are zealous over-estimate the value of the profession. There is no good reason why an engineer should not cultivate and enjoy the society of his fellow men. The setting of one's profession on a pinnacle, to be worshiped as the only real object in life, is unwholesome, and it defeats its own ends. Engineers should be seen at other places than at a desk, or leaning over a drawing board, or squinting through an instrument. They ought to be found where their fellow citizens congregate for any purpose affecting the common good, and they should take their part in such meetings.

A German Electric Candle

Everybody knows the defect of the ordinary arc light wherein the carbons are placed vertically, one over the other, with a consequent shading of the space directly beneath. Messrs. Timar and Von Dreger, in Germany, have invented a form of electric candle in which this objection is eliminated. The carbons are placed horizontally, one beneath the other, and parallel. The arc is formed by separating the tips, and experience shows that it does not travel along the carbons, as might have been expected, because of the existence of an electric field between them. The electric field tends, on the contrary, to keep the arc at the tips, and even acts as an automatic regulator, for when the current becomes too strong the arc is forced farther out and becomes longer, thereby increasing the resistance. The light is thrown downward, and by using two sets of carbons facing in opposite directions, a good field of illumination is produced below. This candle is intended especially for indoors.

COALING A WARSHIP BY SEARCHLIGHT

This photograph was taken at the Charlestown Navy Yard and shows how a warship is coaled at night in the almost daylight glare of great searchlights.

Cable Incline in the Tyrol

A new aerial cableway is now running in the Tyrol region of Austria. Starting from the station of Eisack, the passengers enter the comfortable hanging car and then are drawn aloft while suspended from the seemingly frail cable. The car

TOURISTS HAVE A MAGNIFICENT PANORAMA OF THE VALLEY

slowly ascends and when at a great height in the air the tourists have a magnificent panorama of the valley with the lofty mountains in the background, finally reaching the top of the Kehlererberg, where the cable incline ends. This point lies at a height of 2,800 feet above the surrounding country, and the length of the incline is about 5,200 feet. The trip to the top of the mountain is made in thirteen minutes.

A double steel cable is hung upon a series of iron towers and a roller carriage runs along this cable, from which is suspended the car. At the end stations there is a cable running over drums driven by electric motors so as to draw the traveling carriage up the slope. The car will hold sixteen passengers. The drawing cable is endless, so that one car goes up while the second is running down, as is usual in cable inclines. The present line is built by Adolf Bleichert and Company, of Leipzig and Vienna, who favored us with the present information.

Tesla's Plan of Electrically Treating School Children

By E. Leslie Gilliams

Nikola Tesla believes he has found an electrical way of lessening the burdens of school life and the difficulties of acquiring education. A few months ago Mr. Tesla laid before the superintendent of the schools of New York, William H. Maxwell, a plan for making dull pupils bright by saturating them unconsciously with electricity.

Mr. Maxwell, an eminently progressive and practical man, after a careful investigation of Mr. Tesla's plan, arrived at the conclusion that the experiment could not possibly do the pupils any harm, seemed feasible, and to promise the accomplishment of great good.

Therefore he endorsed it for a six months' trial.

News of the new electrical project has leaked out in the school world, and the eyes of progressive schoolmasters all over the United States are now turned towards New York, and many inquiries have been received by Mr. Maxwell, requesting particulars regarding this novel electrical educational experiment.

Nothing in detail, however, will be furnished for awhile, as after the test has been made, careful calculations must be undertaken and conclusions and deductions drawn therefrom. It has been announced that the experiment is first to be conducted on a class of mentally defective children, the most difficult of all pupils to handle, and the bane and trial of every school teacher's life.

Mr. Tesla's plan for the arrangement of the experimental electrical school room, which has received Mr. Maxwell's approval, calls for the installation in this

room of a number of insulated cable wires through the walls. These wires will be so carefully concealed as not to be noticeable to the pupils. Every effort will be made to keep the knowledge of the experiment from them. In general appearance the room will not differ from the ordinary bright, sunny, cheerful school room with its desks and other useful fixtures.

A high frequency current of millions of volts will be generated in an apartment properly arranged for the purpose outside of the school room. When school begins, by simply turning a switch, the high frequency current will be turned on, by one of the instructors, and shortly afterwards the school room will become completely saturated with infinitesimal electrical waves vibrating at high frequency. The whole room will thus, Mr. Tesla claims, be converted into a health giving and stimulating electro-magnetic field, or "bath."

When the inventor's plan was first brought to the attention of the Board of Education in New York, a lively controversy over the benefits of the proposition ensued. A fear existed on the part of some of the members of the board that the stimulation of the defective children, during the experimental period of six months, might be followed by a more or less prolonged or permanent reaction. These educators based their view upon the position taken by Professor W. C. Bagley of the Department of Physiology of the University of Illinois, who has made the statement that it would be years before it could be determined whether bad effects followed such an electrical experiment. Mr. Tesla and other noted electrical experts, who have had great experience with high frequency currents, claim that Professor Bagley is at fault in his presumption.

As proof they point to the fact that Mr. Tesla's project is more than a plan as, in Stockholm, it has already been carried out by Professor Savante Arrhenius with school children and proved most successful. No after effects except those of a beneficial nature have been observed, although they have been carefully looked for.

According to Tesla the high frequency current sets up in the body what he describes as a sort of molecular massage or tissue gymnastics. The tiny particles of which the body is composed are constantly in motion, and the high frequency current causes them to move about in a livelier fashion and increase in number. This unusual activity of the molecules of the human body brings about increased oxidation—the burning up of the waste product of the body by oxygen.

He acknowledges that his plan of stimulating dull pupils by saturating them with electricity is based on the well known theory of stimulating plant growth by electricity—a theory which has been successfully carried out in England by Sir Oliver Lodge, and has also been tried with favorable results by scientists in Denmark and Belgium.

The up to date home of the near future, Mr. Tesla believes, will not only be a place of rest, ease and comfort, but a health resort and a sanitarium as well, making seaside vacations unnecessary.

It will be equipped with high frequency electrical apparatus which will without the knowledge of the inmates keep them constantly charged with electricity, thereby warding off many ills and aches now common, and making the workers always fit for the battle of life. By means of the high frequency currents, he says, all the benefits of the seashore may be obtained right in the crowded city. Instead of spending a few weeks by the sad sea waves every summer, a man and his family may derive all the benefits of the seaside in his own home all the year around.

Upon the authority of George E. Williamson, illuminating engineer of Denver, Colo., that city bears the distinction of being the best lighted city in the country. Denver uses three candlepower per capita and the next best lighted city, classic Boston, one candlepower per capita.

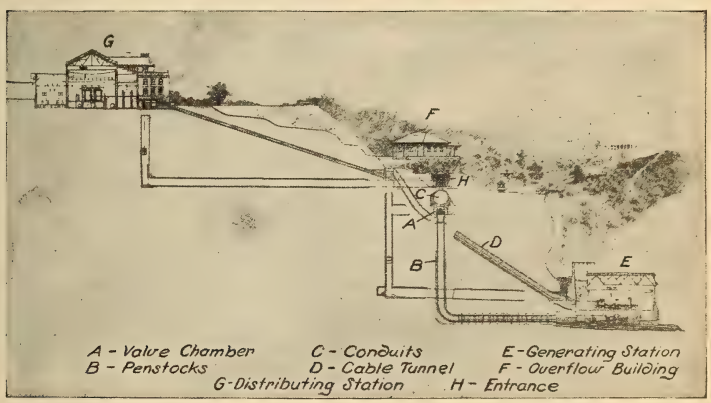
The Ontario Power Plant at Niagara Falls

Of all the great power plants clustered near the brink of Niagara Falls, the largest and one of the most recently built is that of the Ontario Power Company. The general plan of development is as follows: Water is taken from the river on the Canadian shore about a mile above the crest of the Horseshoe Fall, and just above the rim of the first cascade of the upper rapids. After being thoroughly freed from floating ice and debris, it is conveyed through steel and concrete conduits laid underground and steel penstocks tunneled through the solid rock to the generating station situated at the base of the cliff below the Horseshoe Fall.

The electrical energy here generated by means of turbines and generators is transmitted by underground cables to the distributing station located high on the bluff above. From this station radiate the transmission lines which convey the power to the manifold enterprises depending upon it.

The potentiality of the falls is explained by the fact that the Niagara River falls 300 feet in five miles, 50 feet in the upper rapids, 165 feet at the falls, and 85 feet in the lower river. In its entire length of 36 miles the river falls 326 feet. The average flow of the river is 222,400 cubic feet per second. The flow of water over the falls is about 25,000,000 tons an hour, or one cubic mile per week.

In the winter and spring, large quantities of ice come down the river, floating on the surface for the most part, but with enough suspended in the water to impede the successful operation of the plant, were it not removed at the headworks. For this purpose a long intake dam stretches out into the river in a down stream direction, almost parallel to the current, admitting to the forebay only the water at the bottom of the river, while ice and floating debris are carried to the rapids by the swift current that sweeps along its outer face. In the comparative quiet of the outer forebay more ice rises to the surface, to be similarly skimmed off at the screen house, where the water is further cleansed by heavy iron screens. At the gate house the water is again skimmed and finally admitted to the main conduits through large electric-



SECTION THROUGH THE GENERATING AND DISTRIBUTING STATIONS OF THE ONTARIO POWER COMPANY, NIAGARA FALLS

ally operated gates. During the entire 24 hours three men are in attendance at the gate house, each man being on duty eight hours, and he is never out of hearing distance of the telephone.

The gate house is 120 feet long, and divided into six bays, two for each main conduit. The entrances to the conduits are guarded by large gates, 18 foot and 20 foot, weighing about 40 tons each, including the counterbalances. The gates are operated by electric motors. The screen house is 320 feet long, built of reinforced concrete faced with Roman stone. Broad ornamental stairways at either end lead to the roof, where a spacious promenade, open to the public at all times, commands a magnificent view of the upper rapids.

The inner forebay is a quiet pool of two acres area and 20 to 30 feet in depth. Here the water has a final opportunity for being cleared before entering the conduits, and it is this cleared, purified water which, by virtue of its potentiality, actually does the work down below the Horseshoe Fall. From the conduits the water enters steel penstocks nine feet in diameter, through electrically operated valves. The penstocks lead vertically downward to a level slightly below that of the generating station floor, then, turning at right angles, lead horizontally to the turbines.

The entrance to this remarkable power plant is modest and unobtrusive, so that the visitor is but little prepared for the marvelous skill and ingenuity displayed in the construction. One passes through double doors, enters an underground elevator and descends to the valve chambers; these are built beneath the lower ends of the main conduits, and they are approximately 300 feet long, ten feet high and sixteen feet wide, with arched concrete roofs to support the conduits above.

After leaving the valve chamber, one enters the elevator again, descends 120 feet and passes through a 250 foot tunnel to the generating station, the walls of which are of concrete, the rear wall being twelve feet thick and the river wall nine feet thick. Here are installed the enormous horizontal turbines, made in Germany, and the ten huge generators, seven of which were built in this country and three in Canada.

Cable tunnels and conduit systems lead from the generating station to the distributing station on the hill. The electrical power is thus conducted in lead covered cables to the bus-bars. From the bus-bars the power is distributed through cables to the transformers, where the voltage is stepped up from 12,000 to 60,000 volts. At this voltage it is sent out on the lines, some of it going as far as Syracuse, N. Y., 160 miles away.

Odd Effects of Electric Currents

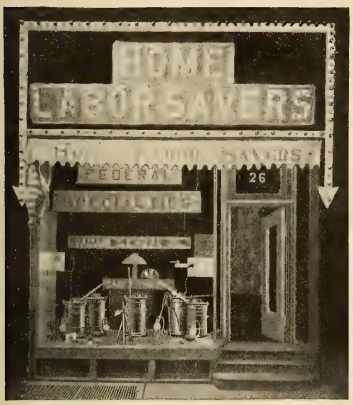
In a Brussels street traversed by an electric tramway it has been noticed that the trees on one side of the way begin to lose their foliage early in August, the leaves turning brown and dropping off. But in October the same trees begin to bud again, and sometimes even blossom. Meanwhile the trees on the opposite side of the street are unaffected, losing their foliage late in the autumn and budding only in the spring. The cause of the anomaly is supposed to be leaking electric currents, which stimulate the growth of the trees affected.

Transmission Voltage 150,000

The voltage at which transmission lines are operated creeps steadily upward from year to year. So far 125,000 volts has been practically the limit of operation. It is now planned, however, to transmit current from the new Big Creek plant of the Pacific Light and Power Company at a pressure between 150,000 and 175,000 volts; the line will be 275 miles long. Some Pacific Coast engineers assert that the climatic conditions in California are so favorable that 200,000 to 250,000 volts may be employed in future power transmission projects.

Opportunities of the Electrical Store Window

Objects of spectacular interest and of artistic design make up the greater part of the regular stock of every electrical supply store, and there is really little excuse for the tradesman in this line who does not make his window the most attractive of any in his block. There are



EXCELLENT EXAMPLE OF AN ELECTRICAL WINDOW DISPLAY

ample opportunities for displaying working devices driven by motors, artistic lighting fixtures and table lamps, and the adroit use of those miniature lamp letter signs that tingle one's optic nerves like letters bent from white hot rods of steel. In addition, there are remarkable and mystifying stunts which can be performed with the invisible forces of electricity and magnetism, everything, of course, to be overtopped by an elaborate electric sign distinctive from any in the vicinity and in keeping with the nature of the goods to be sold. In other words, if you are selling electrical goods make your store the real electrical center of the locality, and be absolutely lavish in the use of lights.

The picture presented herewith is an excellent example of the attention drawing qualities that may be secured in the relatively small space of a single window and entrance. It is the Federal display room in Monroe Street, Chicago. The electric sign draws you, and once there the window holds you like the pages of an illustrated book, there are so many things to be studied over, marveled at and surmised about.

Search for Particle of Lost Radium

Tedious but exciting the search for a tiny particle of lost radium, now being made by a Birmingham firm of chemists, says the London *Daily Mirror*.

This precious particle, worth about $486 and one-thirteenth of a grain in weight, it is hoped to recover from a quantity of ashes taken out of a bedroom fire grate.

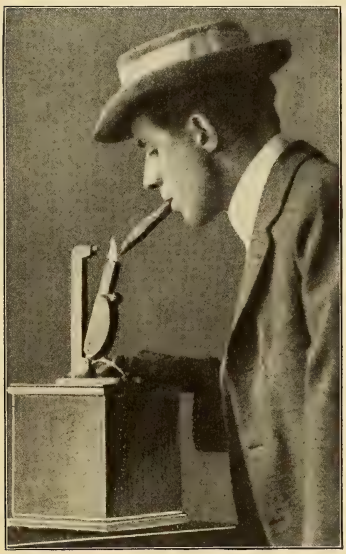
The firm hires out radium, and this particular portion, contained in a little holder known as the applicator, to which it was attached by strong varnish, was let to a local doctor. After applying the radium to the body of a patient, the doctor removed the applicator and the surgical dressings at the same time, and inadvertently threw both onto the bedroom fire. As the bandages flared up, the doctor realized his mistake, but it was too late to rescue the radium, for the varnish had perished and the precious particle had mingled with the cinders.

Collecting all the ashes in the fireplace, the doctor placed them in a cardboard box and sent them to the owners of the radium. Tests were applied, and these showed the ashes to be radio-active and to contain 4.5 out of the five milligrams (one-thirteenth of a grain) of radium originally contained in the applicator.

It is proposed to reduce the ashes to powder by slow ignition in oxygen—in fact, to heat the concentrated ashes by the same method as that used for the extraction of barium. The process is difficult and will take a considerable time.

Battery Cigar Lighter

The illustration shows a compact cigar lighter in use at many cigar stands. Within the box are three dry cells and a spark coil. Upon the end of the scissors-



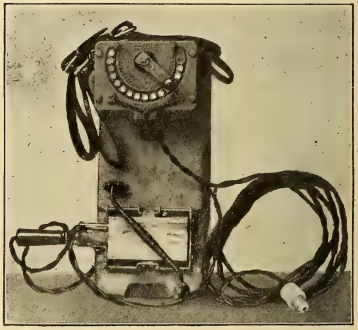
BATTERY CIGAR LIGHTER

like arm is an asbestos wick kept automatically saturated with gasoline. As the movable arm is pressed outward against a spring, an electrical contact is made and broken by a point on the upright, and a spark ignites the wick. When released, the wick is thrown back against the upright and extinguished.

Tire Economy

The initial cost of automobile tires compels the owner to take every precaution to keep them in good condition for as long a period as possible. Unless properly attended to when first discovered, a hole in the shoe grows rapidly and soon tears out.

Repairs can be made with a vulcanizer, like the one shown, quickly and satisfactorily at home. The heating element consists of a metal ribbon imbedded in mica and hermetically sealed in the vulcanizer casing. In from fifteen to 45 minutes, depending on the cut, a patch can



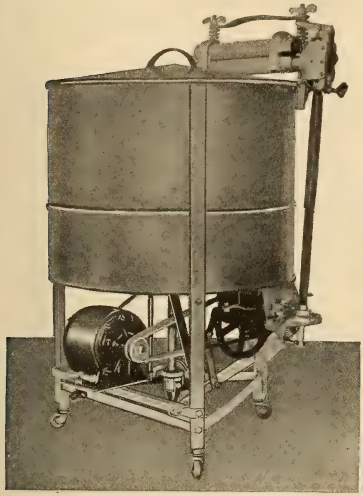
ELECTRIC TIRE VULCANIZER

be placed on the tire and thoroughly vulcanized.

The temperature of the vulcanizer is held at 275 degrees. The heat is controlled through the regulation of the current by the rheostat. The device operates on any lighting circuit of the usual 100 to 125 volts.

The "Easy" Washing Machine

The principle of washing consists in forcing the soap suds through the clothes, and was accomplished, before the advent



A NEW TYPE OF WASHING MACHINE

of the washing machine, by rubbing the clothes against a board.

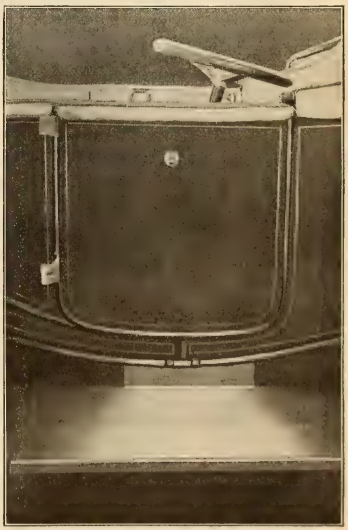
The Easy motor washer here shown utilizes the above principle by means of an electric motor which raises and lowers rust proof metal funnels or basins through the soapy water. These basins are attached to a yoke which is in turn fastened to a center bar. The electric motor is mounted on the frame under the wash pan in an accessible place.

The machine is equipped with a wringer, which is also operated by the motor through a set of silent, enclosed bevel gears, the power being transferred from the washer basins by a clutch lever conveniently located near the bottom of the tub. This lever can be operated to transfer the power from wringer to washer and vice versa without stopping the motor. The wringer can be reversed by a small lever located near the upper roll.

The entire machine is mounted on channel steel legs and roller bearing casters, weighs about 130 pounds and can be conveniently wheeled about the floor.

Automobile Step Light

Builders of electric cars are ever on the lookout for features that add to the convenience and desirability of their cars. One of these little innovations is presented in the illustration. A few inches above the step, close up to the body of the car and out of the way, is a small electric lamp and an elongated reflector so placed that the light is thrown directly upon the step. In the evening, when entering or leaving this car, the Argo electric, it is only necessary to press a push button just inside the door, and the danger of making a misstep is eliminated by a flood of light in the right place.



AUTOMOBILE STEP LIGHT

Measures Cost of Operation

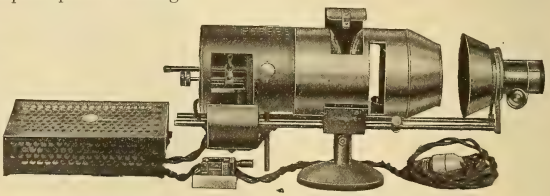
THE ENERGY-COST METER

One of the important questions asked by the buyer of an electrical device is: How much does it cost to operate?

The accompanying illustration shows a new device, the Energy-cost meter for use where things electrical are sold. When any energy consuming device is connected to the meter the hand points at once to the number of cents per hour that it costs to operate. With the meter the customer is able to see for himself and is a satisfied patron.

A Compact, Portable Stereopticon

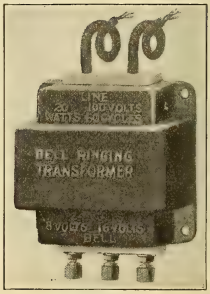
While experiments have been made with high candlepower incandescent lamps as the source of light for projecting lanterns, these were not strong enough to give sharp, clear pictures. The use of the carbon arc gave proper results. The lamp shown uses 5/16-inch carbons adjusted by hand feed apparatus, smaller but upon the same principle as the large lanterns. The carbons last for four hours without renewal. At 60 feet from the screen a twelve-foot picture is produced. A rheostat and switch with cord and plug for attaching to a lamp socket are part of this Miopticon outfit as it is called. The lamp sets on a 5½-inch base, and the whole equipment is carried in a case 20 by 6¼ by 10½ inches. In fact, the entertainer or educator may start out with his lantern in one hand and his slides in the other.



STEREOPTICON THAT CAN BE PACKED IN A SUITCASE

Bell Ringing Transformer

The use of transformers for reducing the voltage of the lighting circuit so that it may serve to ring bells and operate electric toys has become common. The light, compact transformer shown in the illustration will give eight to sixteen volts fully loaded and 24 on light load when operated from a 110 volt circuit. Binding posts are provided and the transformer is mounted by lugs cast on the case.



TRANSFORMER

An Adaptable Small Motor

Some one has said "Human labor is the most expensive form of energy. Any machine that is in even occasional use should be run by an electric motor where current is to be had."

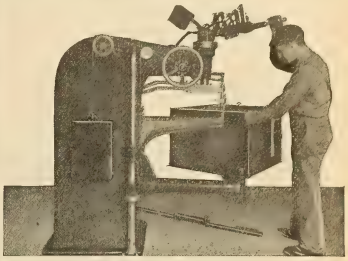
The illustration of a one-eighth horse-

ADAPTING A SMALL MOTOR TO A HAND DRIVE WASHING MACHINE

power Westinghouse motor driving a hand power washing machine strikingly exemplifies the quotation, and is equally forceful in showing an arrangement that may be used to operate the wringer, the ice cream freezer, or the shop lathe. All the running parts of the motor except the driving end of the shaft are fully protected by a metal framework.

Electric Stove Welder

In stove factories extensive use is now made of spot welders, electric welders which do work every bit as good as riveting and in much less time. The two parts which are to be welded are placed together and upon the terminal at the end



WELDING A STOVE PLATE

of the horizontal arm of the machine shown in the picture, one side of the electric circuit being connected to this peg-like terminal. Pulling down the lever brings the upper terminal, shaped like a punch, down upon the work. A very heavy current then flows from one terminal to the other through the metal of the two parts to be welded. Almost instantly this metal, at a little spot no bigger than a rivet, begins to glow—first red then white hot. At this temperature the pressure welds the two sheets together in less time than it takes to read this, and they are as firmly united as if a rivet had been put through.

While it may perhaps be supposed that the utilization of water for the development of power interferes with if it does not prohibit log driving, the statement is made that as a matter of fact the two industries in Maine have worked together satisfactorily. Of course this co-operation has involved a more economical use of the water, for it is stated that wherever a dam has been built to develop power the conditions have, in general, been improved for log driving.

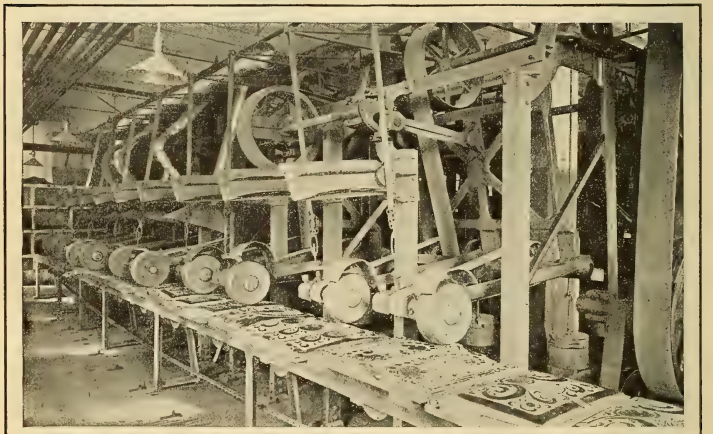
The Grinding of Stove Plates

Not only does one observe in a modern stove factory the innumerable small applications of short cuts in intricate manufacturing processes, but he also comes in contact with great, nearly human machines which cut time and cost into negligible fractions. Such an example is the automatic stoveplate polishing machine.

Previous to the advent of this time saver, stove tops and sides were ground, polished and trimmed by hand—an expensive process considering that skilled labor of the highest class was required. Now, one electrically operated machine does the work of a dozen men at a fraction of the former cost.

The plates which go to make the top and sides of a stove and to which it is desired to impart a polished surface, are placed upon a slowly moving belt geared down so low that it moves almost imperceptibly. A coarse grained abrasive wheel at the end of a long, pivoted arm swings out back and forth across the slowly moving plate, bearing down with sufficient pressure—obtained by adjustable weights—so that the rough surface is partially removed. As the plate is carried beyond the scope of the first wheel it comes within range of another of slightly finer grit, secured, as the other, at the extreme end of a long, swinging arm, which, sweeping back and forth over the plate, grinds it to a still finer surface.

In this manner, the iron lids pass under a series of ten wheels, each one of finer grit than the one preceding; the last ones being leather, faced with emery cloth for polishing, and the very last an oiled cloth wheel. The result is a smooth, satiny surface, and the oil prevents the accumulation of rust.



THE IRON LIDS PASS UNDER A SERIES OF TEN WHEELS

Powerful suction pumps, actuated by electric fans, are located behind the wheels to remove the powdered iron, and the grinding rooms are surprisingly free from floating dust.

The first telephones were used both as transmitters and receivers and there was usually posted up a rule that read: "Don't talk with your ear or listen with your mouth."

Electric Truck in Twine Factory

The electric truck which has been found most efficient in handling baggage, mail and express matter is finding a place in manufacturing plants.

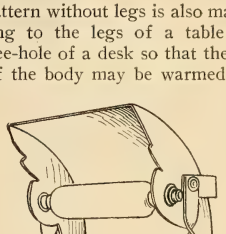
ELECTRIC TRUCK IN A TWINE FACTORY

The illustration shows one of these trucks in a thread and twine plant handling a load of flax bundles. The superintendent of the factory states that this truck performs the work formerly done with a two horse team and five men. The storage battery is located at the front end of the truck and will operate it for ten hours at a cost of from twelve to eighteen cents.

A Reflecting Heater

A new reflecting heater brought out by an English firm is the result of considerable experience in electric heating. With the usual radiators, the warm air rises to the top of the room, and even after such a heater has been turned on for some time the portion of the air near the floor is often found to be cold, as the warm air needs to rise at first and then be forced downwards. In the Murray reflecting heater this drawback is overcome, since the heat rays are sent directly onto the floor by using a movable parabolic mirror placed behind the lamp. In heating a large area, a suitable number of these single lamp devices can be employed.

A pattern without legs is also made for screwing to the legs of a table or in the knee-hole of a desk so that the lower part of the body may be warmed better than is done by the other electric or steam heaters that may be in the room, especially in large offices.



A REFLECTING HEATER

Electrical Men of the Times

PHILIP STEPHENS DODD

To make good nowadays one must have the faculty of acquiring friends and of keeping these friends always loyally inclined. Philip Stephens Dodd, though young in years, possesses this particular faculty. Four years in the insurance field, two years as sales manager and two in the journalistic field brought him well towards the work in which he is now achieving an enviable success.

In 1912 Mr. Dodd became connected with the *Electrical Review* and when this magazine moved its headquarters to Chicago he became acting manager. Brought in contact with prominent electrical men of the day, they recognized his ability and offered him the position of Director of Publicity for the National Electric Lamp Association. Since the dissolution of that association, a few months ago, and the formation of the National Quality Lamp Division, he has been actively engaged in the work of co-operative electrical advertising throughout the United States in connection with the latter organization. Briefly stated, "Phil" Dodd is now, in effect, the good fellow and human pacifier of the electrical industry.

In his early youth and while at school he was an all-around athlete, a champion tennis player, a boxer of great skill and hardihood, and a wrestler of considerable prowess. This athletic ability, coupled with a splendid constitution and a most optimistic disposition, has stood him in good stead upon many occasions when he has had to stand the gaff of responsibility, of heavy duty for long periods without a chance for rest and recuperation. He has a most cheerful disposition and a queer blending of courage and fatalistic philosophy. He is, in fact, the man to lead a forlorn hope, or if the conditions are insuperable to accept the fate gracefully and make friends with the enemy.

In a recent statement regarding his work he said: "I am at the present time working for the development of publicity of any character which will serve to give prominence to things electrical and assist in the education of the public to the further use of electric current and current consuming devices."

One plan which Mr. Dodd has most successfully carried out is the formation of co-operative luncheon clubs of electrical men in the larger cities, and 40 of these are now organized.

Another far sighted and valuable effort initiated by Mr. Dodd for bringing before the public the use of things electrical is the "Co-operative Electrical Page" running in but two newspapers a year ago. At the present time twenty-five or thirty newspapers throughout the country run such a page representing a co-operative investment on the part of the electric lighting companies, manufacturers, jobbers, contractors, and local distributing agents everywhere of something

like $265,000.00 yearly.

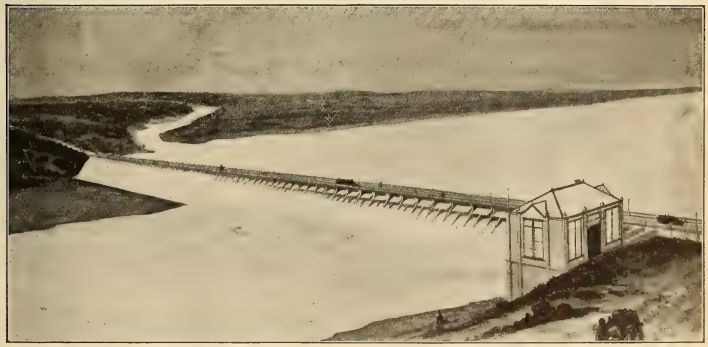
As secretary of the Commercial Section of the National Electric Light Association to which he was elected last year Mr. Dodd is seeking through committees to bring out books upon subjects especially valuable to the commercial side of electricity. Two of these books, "Data on Electric Signs" and "The Electrical Equipment of the Home" are already published while others are in preparation.

Hydro-Electric Dam Surmounted by a Roadway

The accompanying engraving, reproduced from an architect's wash drawing, shows the hydro-electric dam at Austin, Tex., as it will appear when completed. An unusual feature of this structure is the roadway which runs along the top, for vehicular and street car traffic; thus the dam will serve a double purpose.

The structure is being built across the Colorado River and will afford initial energy for generating 7,400 horsepower. Part of this electric current will be transmitted to the municipal waterworks plant, a distance of three miles, and there used for operating the pumps. The excess power will be used for other purposes. The cost of the construction of the dam, the installation of the hydro-electric plant and the building of a 10,000,000 gallon underground auxiliary storage reservoir on a hill north of the city is to be $1,720,000.

The dam will be 1,091 feet long and 65 feet high, and will form an artificial lake having a length of about 29 miles and a width of 400 to 800 yards. About 35,000 barrels of cement and 400 to 500 tons of reinforced steel will be required. This new dam is to replace the original structure that was washed away by a flood in the river more than twelve years ago.



THE DAM AT AUSTIN, TEX., WHICH WILL ALSO FORM A BRIDGE

Ingenious Advertisement

Taking advantage of the collision between a large motor truck and a lamp post, which bent the latter in half, so that the glass enclosed osram incandescent lamp was bowed completely down to the pavement, the manufacturers of the particular form tungsten lamp had the doubled up post photographed and are using it as an advertisement. The intact incandescent continued to burn despite the accident, so the firm have an advertisement running thus:

Down
but
not
Out!

Electrical Interests of Women

EDITED BY GRACE T. HADLEY

Mr. Flannerty Goes Hunting

"I think I will go hunting," announced Mr. Flannerty at the dinner table. It was late in November, and preparations were in evidence everywhere for Thanksgiving.

"You never bag anything but your trousers," said Mrs. Flannerty. "I was planning a nice Thanksgiving dinner, and I thought we would ask Mr. and Mrs. McGinnis."

"Well, I'm sorry, but I've got to get away for a few days. I have been so tied up in the office lately, and then my friend, Mr. Roosevelt Withrow, will be in town soon, and we both need the outing."

Mrs. Flannerty did not reply for a full minute. She was deeply disappointed, but the "best laid plans of wives and widows gang aft aglee."

Finally she said: "I wish I had an electric broiler!"

"Your remark is scarcely apropos," said Mr. Flannerty. "I do not catch the connection."

"The connection isn't made yet," said Mrs. Flannerty. "The circuit is not complete."

"I think I will go upstairs and look up my hunting togs," announced Mr. Flannerty, briskly. Five minutes later he was back in the library, immersed in the evening paper. Mrs. Flannerty strolled in and, picking up a magazine, began to turn the pages idly, stopping now and then to study the photograph of some favorite stage beauty.

"Oh, by the way, dear," said Mr. Flannerty, "I couldn't find my shooting jacket or my leggins, or, in fact, any of my togs. I wish you would look them up—will you, dear?"

"Perhaps, to-morrow," said Mrs. Flannerty. "I'm busy now." And she continued to turn the pages of the magazine.

The next morning when Mrs. McGinnis called her up, she casually mentioned the fact that Mr. Flannerty was going hunting over Thanksgiving, and Mrs. McGinnis promptly invited her to dine with them on the national Bird Day. When she hung up the receiver at the end of ten minutes she had regained her usual cheerfulness. She spent the balance of the morning looking up Mr. Flannerty's hunting clothes and mending the rents in them.

On the following Wednesday evening Mr. Flannerty brought home with him his friend, Mr. Roosevelt Withrow, and the two men behaved like a couple of boys let loose from school.

"Good-bye, good-bye," shouted Mr. Flannerty to his wife in the doorway. "When we come back you shall have quail on toast."

"I prefer eagles on ten dollar gold pieces!" was Mrs. Flannerty's parting shot.

That night the weather changed. It turned bitterly cold and a light snow fell. The two hunters were bound for the Ozarks—that gentle uplift of wild woodland extending over central and southern Missouri. They arrived at the village of C—— at the interesting hour of 3 a. m. After a rest and a hearty breakfast at the home of a friend, they

drove six miles further into the heart of the hills and put up their horses in the barn of a native Ozarkian. The family consisted of the native himself, his wife and three grown-up children. They all lived in a one room cabin, but they had a fine barn for the stock.

"We're goin' to build a house afore long," remarked the head of the family; "not that we need it, but we hev' allowed mebbe we better build in the spring."

The sixteen year old son of the household was engaged to act as guide. He abound with game. Wild turkeys are plentiful, but on this particular day they had business elsewhere. So did the quail. In July the quail will stand out in the middle of the road and look at you fearlessly or whistle to you from a rail fence, but they know when the hunting season opens. The two hunters harnessed their horses and drove back to the village in the bitter cold of the early dusk. A good hot dinner revived them, however, and Mr. Flannerty rubbed his ankle with horse liniment. Their train was due

MR. FLANNERTY SPRAINED HIS ANKLE JUMPING A FENCE

was as sharp sighted as a Canadian trapper.

"See that rabbit?" he would say to the city "fellers" who were trailing him through the brush.

"No—where?" they cried, excitedly.

"Right there! Don't you see his eye?" Before they could even glimpse the rabbit, bang! went the boy's gun, and the rabbit was dead.

They tramped miles and miles, and Mr. Flannerty sprained his ankle jumping a fence. Then they had to tramp back again to the cabin. The Ozarks at 9 p. m., but on account of the blizzard it did not arrive until 1:15 a. m. The two hunters huddled together in the wretched little waiting room at the station. During the early part of the evening the natives grouped themselves about the redhot stove and discussed the city "fellers" in an audible undertone.

"Who be they?" inquired Hi Stimson, as he bit off an extra chew of Battle Axe.

"They be two hunters from the city. One of 'em is named Roosevelt," announced Mart Hoover, who made it his business to acquire all information pos-

THAT MAKES A TOTAL OF $15.00 FOR TEN RABBITS

sible regarding all newcomers in the village. Old Hi pricked up his ears and edged about so as to get a squint at Mr. Roosevelt Withrow.

"Be he related to Teddy?"

"Sure!" said Mart. "He must be. They's both hunters."

"Bag anything?" inquired Hi.

"Rabbits!" remarked Mart, with the laconic brevity of the Ozark native.

There was a burst of laughter from the vicinity of the stove, which caused the two gentlemen from the city to find a sudden interest in the landscape outside the window. They strained their eyes trying to see the headlight of the past due train.

One by one the little group about the stove drifted away towards home, and each one going out let in a blast of wintry wind so that the temperature was considerably lowered. Then the fire died out, so that when the two hunters climbed onto the belated train they were half frozen, and they had to take an upper berth.

It seemed to Mr. Flannerty he had not been asleep two hours when he was awakened by a confused murmur which gradually increased to a chatter. He thought he was still in the Ozark woods and had just run upon a tree party of squirrels. He was getting ready to fire when a sudden peal of laughter startled the squirrels and put them to flight. Then he sat up suddenly and realized that he was in the upper berth of a Pullman sleeper. His watch informed him that it was time to be up and dressing, so he threw his stockinged feet over the side of the berth and pushed back the curtains. Eight pairs of eyes were immediately fastened upon him. Directly opposite were four pretty girls, chattering and eating oranges. There was a sudden silence as their eyes fell upon the figure in pajamas perched away up on the edge of the berth. Girl-like, they giggled. Mr. Flannerty clutched the curtains and fell back in the berth in a sudden panic. How was he ever to get out with a lame ankle and four pairs of saucy eyes fixed upon him? Fortunately, something sent the four girls trooping to the other end of the car, and Mr. Flannerty managed to slip into his trousers and get to the lavatory before they returned.

Home looked good to Mr. Flannerty, and Mrs. Flannerty was most agreeable. She had had a beautiful time at Mrs. McGinnis'. The baron and several other chosen friends had dined with them, and then they played bridge all afternoon, and Mrs. Flannerty had won the ladies' prize—an electric curling iron!

Mr. Flannerty took ten rabbits out of his hunting case and proudly presented them to his wife.

"Well," said Mrs. Flannerty, "I can buy these at the market any day—two for a quarter! I thought you were going to bring home some quail!" This proves how unappreciative wives can be.

"How much was your railroad fare?" she inquired.

"About eight dollars," said Mr. Flannerty, a trifle uneasily. He wondered what on earth she was driving at.

"And your sleeper, I presume, was two?"

"Yes."

"That makes ten dollars. And your incidental expenses?"

"About five dollars."

"That makes a total of fifteen dollars for ten rabbits, or a dollar and a half apiece," announced Mrs. Flannerty, with mathematical exactness.

"But you forgot to count in the fun —the sport," protested Mr. Flannerty.

"Well," said Mrs. Flannerty, with fine irony, "I could not think of cooking such expensive game on my old broiler—besides, it's broken." So she went at once to the telephone, ordered an electric broiler, which she had wanted for some time, and had it charged to Mr. Flannerty.

Broiling by Electricity

The new "American" broiler is not to be compared with the ordinary electric broiler. This new broiler holds the meats vertically and the heating is done by means of red hot heating elements attached to the side walls of the broiler. These elements heat instantly, no time being lost in waiting for the broiler to heat up. A small steak may be broiled in six minutes from the time the current is turned on. The thing to be broiled is not brought into contact with the heating element and the cooking operation is done under ideal conditions, as there is no flame or combustion, hence no odor, fire or danger.

The time required to perform various operations, starting everything cold, varies. Steaks, from four to fifteen minutes; chops, from four to eight minutes; squab, quail, chicken or other fowl, from five to ten minutes; toast, from one to two minutes; baked potatoes, about 30 minutes.

These broilers are so arranged that the grease will drip and drain into a pan at the bottom.

Toast Stove Hints

ENTIRE WHEAT GRIDDLE CAKES

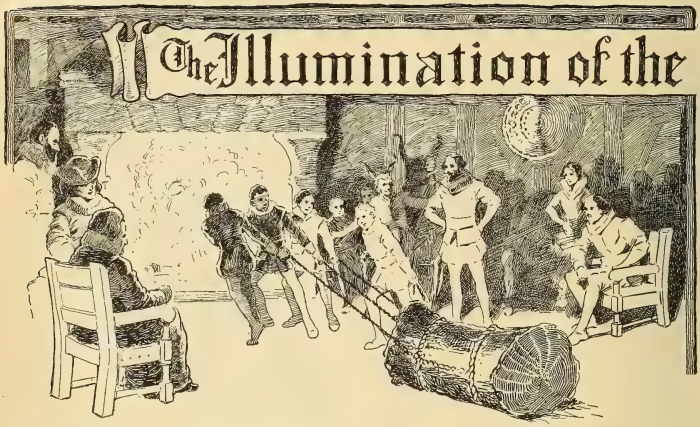
Mix and sift ½ cup flour, ¼ cup entire wheat or graham flour, 1½ teaspoonfuls baking powder, 1½ teaspoonfuls sugar, and ¼ teaspoonful salt. Add ½ cup milk, 1 egg, slightly beaten, and ½ teaspoonful butter, melted.

Use the griddle of the toaster. Turn on the current, allow the toaster stove to stand until the griddle gets hot.

Drop the batter on to the griddle from the tip of a spoon. Cook on one side until delicately brown, then turn and cook on the other side.

THE NEW BROILER HOLDS THE MEATS VERTICALLY

The Illumination of the



Christmas means the festival of the Nativity of Christ, and the scene of the Nativity has been placed in a cave; over this cave has been erected the Church of the Nativity, and there is a stone slab with a star cut in it to mark the spot where the Saviour was born. The appearance of the miraculous Star of Bethlehem may be regarded as an important feature of the first celebration of the Nativity, and the angels' song has been called the first Christmas carol.

The birth of Christ was fixed at the time of the winter solstice; thus Christmas came at the time of the year when the most celebrated festivals of the ancients were held in honor of the return of the sun, which at the winter solstice begins gradually and apparently to ascend in the horizon. Northern nations kept a festival at this time, called Yule, which was a mingling of much feasting, dancing and religious rites. The Romans had festivals with apparently the same object as the Yuletide and other nations had something similar.

The Christmas entertainments of King Arthur were princely pageants, and Christmas at York was kept with great joy and festivity. The round table was filled with jocund guests, minstrels, harpers, jugglers and dancers. Enormous log fires furnished not only the necessary warmth, but afforded the principal means of illumination. William the Conqueror kept the Christmas festival with unusual splendor, and Richard the First, that king of great strength and courage, made magnificent festivals abroad with other potentates.

One of the earliest illuminants was the torch, a stick of resinous wood. The torch gave but a fitful and wavering light, but it was a standard method of illumination for some time. Sir Walter Scott gives a vivid pen picture of a banquet hall where "behind every seat stood a gigantic Highlander, . . . holding in his right hand his drawn sword with the point turned downwards and in his left a blazing torch made of bog pine."

An English writer states that if you go into the Duomo late on Christmas Eve, you find the time stained alabaster and dark aisles lit up with hundreds of wax candles over seven feet high. The massive silver lamps suspended across the choir are all ablaze, as is also the graceful chandelier in the center of the nave that glitters like a cluster of stars from dozens of tiny glass cups with wick and oil within. In the solemn and

Christmas Festival

mysterious gloom you pass figures of men and women kneeling in devotion before the many shrines. There is no music, but a deep quiet pervades the dim golden domes overhead and the faintly lighted transepts. Stray rays of light catch the smooth surface of the mosaics, which throw off sparkles of brightness and cast deeper shadows beyond the uncertain radiance.

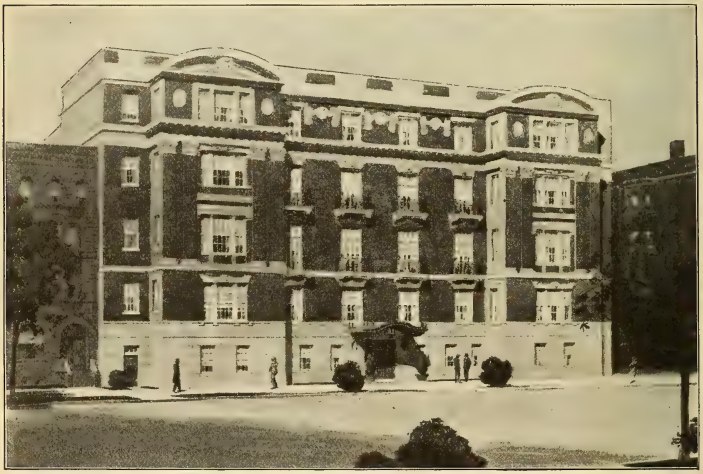
Christmas in Naples is celebrated by fairs, bonfires, and fireworks. The shops on the most famous street, flaming in color, are filled with all sorts of tempting wares. Throughout Christmas Eve a great crowd of men, women and children throng this street, which is nearly a mile in length. The vendors shriek at the top of their voices, praising their wares and themselves, and then with merry peals of laughter exhibit their tricks of trade. As night comes on the mirth grows uproarious, fireworks are let off at every street corner, flaming torches carried in processions illuminate the streets, rockets rise in the air, colored lamps are hung over doorways, and in the midst of the blaze of light the church bells announce the midnight mass. Then the crowds leave the fair and the streets and on bended knee begin to worship.

In America, the modern home is brilliantly illuminated with electric lights and decorated with holly and mistletoe. The chief feature of the festivity, the Christmas tree, is decked with tiny incandescent lamps that are entirely safe and free from the dangerous risk that characterized the old time candle. The little electric lamps are now made in fantastic forms, sometimes in the shape of fruits or animals, even the figure of good St. Nick himself being utilized. The children gather about the great tree laden with pretty and ingenious toys and examine the sparkling treasures with outbursts of joy and childish glee. Then the mother seats herself at the piano and plays a soft prelude, and after the breathless hush of a moment, the childish voices ring triumphantly in the exquisite Christmas carol:

"It came upon the midnight clear,
That glorious song of old,
From angels bending near the earth,
To touch their harps of gold."

An Ideal Realized

To construct an apartment with all the conveniences of a house, to make everything of the very best, to make housekeeping as easy as possible and at the same time to produce a building of beauty that perfectly fulfills these purposes was a problem which has been brought to a successful solution and an ideal apartment house is the result.



THE BUCKINGHAM CHANDLER APARTMENTS

In style, this new apartment is English Renaissance of the time of Charles II. Good taste has been exercised in designing the building and a definite attempt has been made to produce a structure that will grow old gracefully.

Electricity plays a most important part in this modern apartment building, 600 amperes of current being used and five electric motors do the drudgery and the hard work; one motor operates the electric elevators; a slow speed motor runs the ammonia compressor of the refrigerating apparatus in the basement, the vacuum cleaner is motor driven and the brine pump, while the house pump is a triplex installation.

Four large apartments and an English basement are built around a fountain court ornamented with flower beds, terrace, vases, backed by a garden wall covered with vines. The solid bronze entrance door admits one to a harmonious hall with delicate French gray marble walls and ornamental plaster ceiling. Very handsome electric floor standards afford adequate illumination and the electric elevator lifts one to any of the main floors by the simple pressure of a button.

The rooms show that special care and attention have been given to an arrangement that is most convenient for entertaining; four large openings with wide sliding doors make four rooms practically open into one. The lavishness in electric light outlets for electric lamps, floor standards and all electrical devices, is noticeable, as such outlets are found on nearly every baseboard. "I have noticed," said Mr. Buckingham Chandler,

who planned these up-to-date apartments, "that if there are only two electric light outlets in a room, they are never where you want them, so I decided to have plenty of them everywhere."

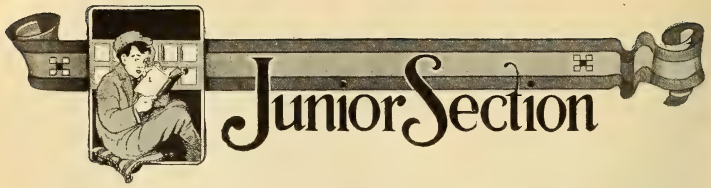
Just outside the dining room is a safety vault for holding table silver, tea and coffee sets. It is built into the wall and protected by a paneled door to which is attached an electric burglar alarm. Opening one of the mirrored doors at the end of the foyer hall a wide corridor leads to the master's bedrooms. The first door leads into a room that is oval in shape with large triple mullioned windows facing the fountain court. On each side of the bed are doors, one to a large closet with shelves, drawers and hangers, in one end of which, built into the wall, is a jewel safe with combination lock. The door to the closet is connected with a burglar system controlled by a concealed switch, which also controls the vault for the table silverware, and special connections have been made so that when the occupant of the apartment is away for the summer, the burglar alarm can be made to ring in the janitor's apartment if protecting doors are molested. On the side of the bed is an outlet for an extension of the public telephone.

The door to the bathroom has a full length mirror on its inner side. The solid porcelain tub is recessed and the walls are of milky white glass. The bathroom also has its telephone from which the master may telephone to any of the four stations in his apartment, to the garage, the laundry, the boiler room, the janitor and the entrance hall downstairs. There is an outlet for the attachment of an electric heater or luminous radiator.

A HARMONIOUS HALL OF DELICATE FRENCH GREY MARBLE

The kitchen with tile floor is of good size and shows careful planning of sinks and stoves, including an outlet for an electric cooker. In the butler's pantry there is a special radiator for warming plates, also a connection so that in summer, with the heat off, the plates can be warmed by electricity. The entire service quarters can be shut off from the balance of the apartment by closing the dining room pantry door and the door from the rear corridor to the service dining room. The laundries are on the upper floor so that no odor of washday can penetrate to the apartments below. There are seven large individual laundries each with its laundry tubs, clothes' dryer ventilated to roof, and a number of electric outlets for the attachment of electric washing machines and irons.

In every possible way the electric current has been utilized in this ideal apartment building, not only for artistic illumination, but for cooking, sweeping, cleaning, washing, ironing and all the homely housekeeping tasks. As woman becomes emancipated more and more from the drudgery of housekeeping, she becomes more and more an artistic homemaker through the practical applications of the electric current.



Training Youth for the Electrical Age

Board a Van Buren street car in Chicago's "Loop District" some morning about eight o'clock and ride west. If the car is not hindered by traffic, you will reach Oakley Boulevard in time to see scores of boys and young men with school paraphernalia entering an imposing four story building upon the northeast corner—the R. T. Crane Technical High School.

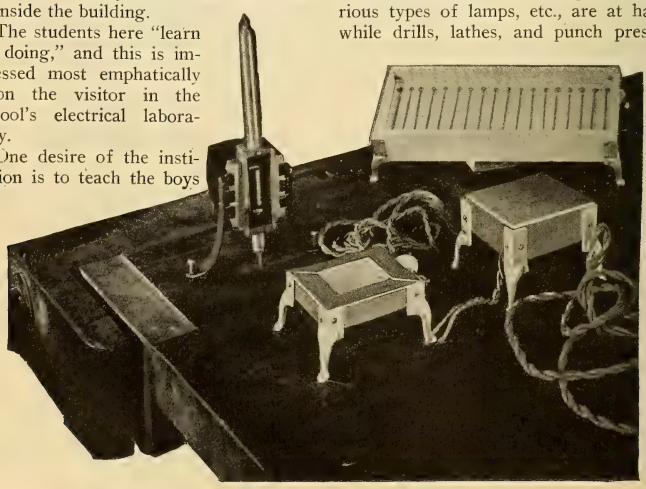
There is a spirit of eagerness and pleasure about these young fellows often found lacking in the student of the ordinary high school, and the reason for this contrast is readily found once the visitor is inside the building.

The students here "learn by doing," and this is impressed most emphatically upon the visitor in the school's electrical laboratory.

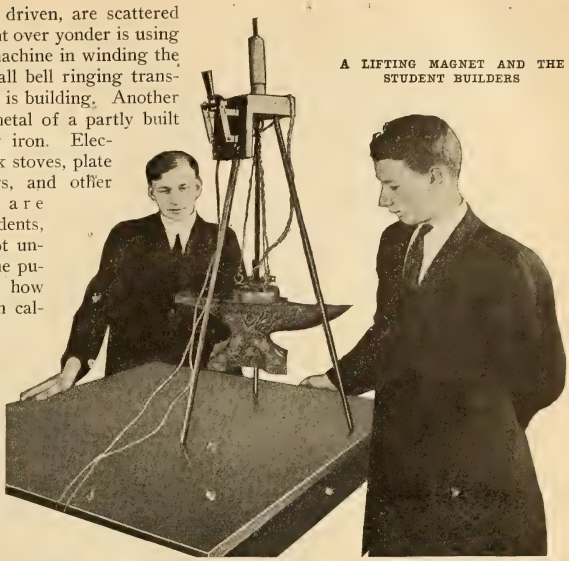
One desire of the institution is to teach the boys to use their hands as well as their heads, but as one instructor puts it, "We endeavor to keep the head a long way in advance of the hand."

One's first impression of the electrical laboratory, which is located on the third floor, is formed at the doorway—a place for the hands to work. At the benches around two sides of the big room 30 students may work at one time. Both alternating and direct current are at the service of each pupil, who controls his supply by switches independently of other students.

Voltmeters, ammeters, lampboards, various types of lamps, etc., are at hand, while drills, lathes, and punch presses,

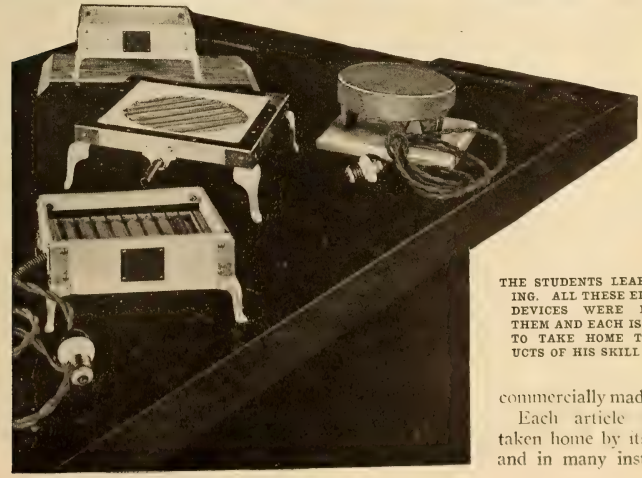


each electrically driven, are scattered about. A student over yonder is using a coil winding machine in winding the wire upon a small bell ringing transformer which he is building. Another is drilling the metal of a partly built electric pressing iron. Electric toasters, disk stoves, plate warmers, curlers, and other home devices are made by the students, but these are not undertaken until the pupil understands how to make his own calculations.



A LIFTING MAGNET AND THE STUDENT BUILDERS

The body of the toasters is constructed of asbestos board, while the metal legs and framework are made by the students in the foundry and machine shop. Nichrome wire is used for the heating elements, and a finished toaster may readily rank as to efficiency and finish with its commercially made cousin.



THE STUDENTS LEARN BY DOING. ALL THESE ELECTRICAL DEVICES WERE MADE BY THEM AND EACH IS ALLOWED TO TAKE HOME THE PRODUCTS OF HIS SKILL

Each article made is taken home by its builder and in many instances it

is, with the students' knowledge of electricity, a direct cause of the adoption of electricity in the home. In fact, students' homes have been wired for electricity that before knew only oil or gas illumination.

Hand in hand, but always a little ahead of the construction work, is the theoretical. For each semester of a year in the laboratory, there are arranged 20 subjects for investigation, so that at the close of the year's work the student has come in touch with the electrical field at 40 points.

One of the aims of the school is to assist the apprentice learning a trade to obtain theory as he works out his apprenticeship on the outside. While the apprentice electrician, for example, may be getting along well with the manual work, a certain amount of practical theory scattered along enables him to come through a better master of his trade. In this regard the school is extending its efforts to the apprentices of labor bodies with excellent results.

With the students from this and other similar schools going out with an intelligent knowledge of the service that electricity may render, the more extended use of this energy will surely follow.

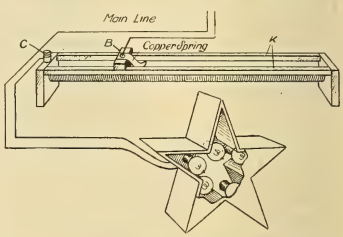
Electric Star of Bethlehem

For Christmas entertainments it is sometimes desired to make use of a large star, the light from which can be regulated so that it can be increased or diminished at pleasure.

The star here illustrated is made of sheet metal or asbestos board, is 24 inches from tip to tip, eight inches in diameter at the inner points and five inches deep inside. Five lamp sockets may be fitted into holes through the back of the star, the sockets holding them in place when screwed on. A better construction is to use a Federal clamp socket to hold the lamps.

The sockets are connected in multiple. One lead connects to one side of the lighting circuit and the other goes to a binding post (C) on the dimmer. The open face of the star is covered with tracing cloth or other similar white material and the inside of the star is painted a glossy white to light up the tips of the rays.

The dimmer consists of about 800 feet of very fine copper wire, not larger than No. 36, and uninsulated, wound closely together on an asbestos rod two inches in diameter. This rod is mounted on a frame and one end of the fine wire con-



STAR OF BETHLEHEM

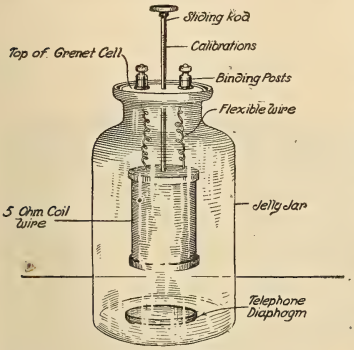
nects to the binding post (C). The other end of the fine wire is fastened to the rod with a tack. The frame of the dimmer has two slide bars (K) nailed on top, and the sliding block (B) moves along these bars. This block has a strip of spring copper fastened to it that is bent down so it touches the wire on the stick, lightly but positively. The other wire from the main circuit is connected to this copper spring.

Set the block at the end of the dimmer away from the binding post. Turn on the current. Then move the block slowly along toward the other end, making sure that the spring touches the wire all the time. Do not bear on so hard as to move the coils of wire. As the block is moved along the slides, the resistance in the circuit is lessened by cutting out the coils of fine wire and the lamps will begin to glow faintly. The closer to the binding post the block is moved the stronger the lights will become.

If this apparatus is used in a darkened auditorium while a solo centering around the Star of Bethlehem is sung the effect will be striking.

Unique Ammeter

The ammeter I am about to describe is, as far as I am able to ascertain, entirely original. Although the diagram is sufficiently explanatory, I trust a few words of elucidation will not be amiss. The one I constructed consists of a jelly jar,



UNIQUE AMMETER

the top of a Grenet (bichromate of potash) battery cell, a five ohm coil of wire and a telephone diaphragm. To the sliding rod, screw on the five ohm coil, which, if obtained from a telegraph sounder, will have a hole in it tapped for an 8/32 screw. Lead out the terminals of the coil through the medium of two flexible wires, to the two binding posts on the battery top in the neck of the jar. Place the diaphragm in the jar.

Now calibrate the ammeter by comparing to a standard ammeter in the following manner: Pass a current of say one ampere through the coil, and by sliding the rod on which the coil is mounted up or down, as the occasion may require, a position will be found where the solenoid just attracts the iron diaphragm. Mark the position on the rod by filing a notch in it. Repeat the operation using two, three, etc., amperes up to ten. You will now have an ammeter that is cheap and measures up to ten amperes with a fair degree of accuracy.

Of course any departure from my method which the ingenuity of the experimenter may suggest is permissible, providing the fundamental principle is adhered to.—MAURICE RUBIN.

Another Explanation of the Static Trick

In the October issue of this magazine appeared an article entitled "An Interesting Trick With Static." This was contributed by Charles Ollson, and gives his theory of a phenomenon of the repulsion of particles of dust floating on water by the finger previously rubbed through the hair. This repulsion he attributed to static electricity. Another explanation is, however, presented by S. L. Nash, of Chesley, Ontario, Canada.

"The true cause of this effect is the change of the surface tension of the water, caused by a very small quantity of natural oil from the hair, the same oil that soils hat and cap bands. To prove this theory, use a smooth, round metal rod in place of the finger; the effect is just the same, although the rod will not retain a charge of static if held in the hand, as it acts as a ground unless a person is insulated from the floor by some means.

"Next obtain a small round stick of sealing wax, about six or eight inches long, then try the effect on the dust and water before and after charging the wax with electricity. The wax can be charged when dry by rubbing with a piece of silk. It is very interesting to try the effect on the dust and water when the finger is moistened with ether, alcohol, coal oil or gasoline, etc."

New York Telephone Directories

It will take a force of more than 400 men to deliver the fall edition of the New York telephone directory, which consists of 1,385,000 copies. Each subscriber will receive two books, the city and suburban directories. About one million of these directories will be delivered by hand.

Down Rue de l'Etoile to the City of Toys

By EDWARD LYELL FOX

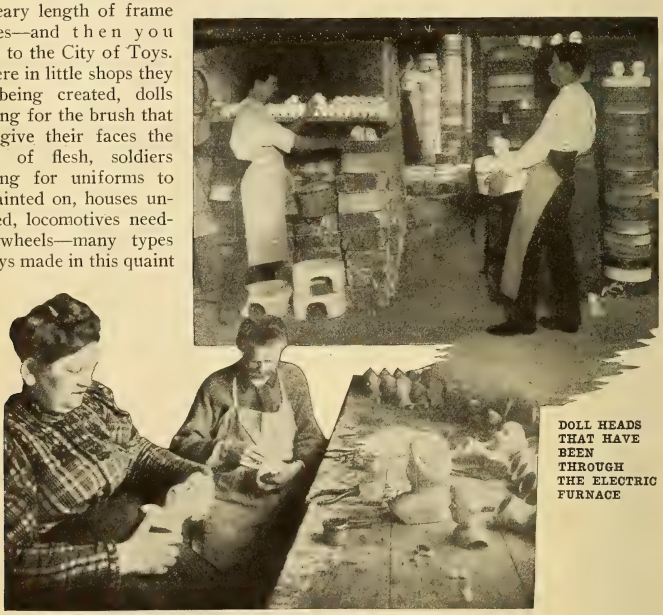
Turn off the pebbled boulevards of Paris and go down Rue de l'Etoile. Past a block of low tin roofed houses you will walk; past a canopied street market where stout *dames* bend over bins of vegetables; past a little dark walled church whose tiny translucent windows give out no brilliance to the sun; past a dreary length of frame houses—and then you come to the City of Toys.

Here in little shops they are being created, dolls waiting for the brush that will give their faces the color of flesh, soldiers waiting for uniforms to be painted on, houses unroofed, locomotives needing wheels—many types of toys made in this quaint section of Paris. And as you pass from window to window, and peering in see parents and children bent over their tasks, you know for the first time that toys are made only with extreme trouble. And if you walk on a little further and come to an old brick building on the corner and stopping there look within, you will also realize that electricity has entered another province—become a mighty force in the City of Toys.

When I tried to enter this building a white haired man rose from a chair and barred my way. In just such a way, it occurred to me, the Ancient Mariner must have stayed the Wedding Guests.

"You cannot go in there," he said in French, his voice cracking.

We asked him why. But he only shook his head with all the stubborness of old men. Then our guide said something to him. They began jabbering, gesticulat-



DOLL HEADS THAT HAVE BEEN THROUGH THE ELECTRIC FURNACE

A GLIMPSE OF WHERE THE DOLLS ARE MADE

ing. For a moment I was afraid the old man would be taken with a stroke, so agitated did he become. Then as suddenly he calmed, and drawing himself up to his pitiful four-score-year-old height he said, as a Marshal might have said:

"You may come in. I, Jacques Voisin, say so. For years, almost after I left the school, I have been the guardian of the secrets of this workshop. Without my word no one could enter. It was necessary because the Germans (he made a grimace) were stealing our methods and copying our toys. You, though, are not German. You may enter."

Within we saw a place of confusion—a low ceilinged room whose windows at the other end bore the stains and dirt of a generation. Later we learned that the frames were nailed down, that the only air freshening the place came through the little square paned windows of the street. So we stood watching and no-one seemed to notice us. They were all too busy. Black eyed, black haired, smiling little children of the Paris slums they were—children for whom the illusion of Christmas had long been broken by the very nature of their work; older children, too, sad faced, white haired and wan, some of them 60 years old, but just as young in thought as that unhappy day when they had been taken from the kindergarten.

The foreman, a short, pudgy man with a pointed beard, came to meet us. Our guide explained our visit and the foreman smiled a welcome.

"Oh, you want to see how we make the toys, do you?" he exclaimed. "You want to write something about them? Very well. *Allez!*"

Saying, he took us up a flight of stairs, explaining as we felt the boards creaking beneath our feet that the room we had just left was the finishing room.

"There," he said, "is where the painting is done."

Finally he stopped before a door—a heavy oaken door, as thick and as slow swinging as the door of a safe. Moving back noiselessly, it permitted us to enter a long narrow room. Instantly the clatter of machines smote the ear. A motor was moaning in a corner. A cobwebbing of black wires hung from the ceiling, falling in strands to each bench. And beside them stood men, aproned in black leather—stolid faced men unlike the Frenchmen you see in cartoons, pipe smoking automatons who ever so often fed a shining piece of metal to the machines, and watched it cut along the outlines of a pattern.

So were the sides of electric cars, tops, stations, fire houses and a score of other toys made. So did a square of bright tin become the engineer's cab, pierced for windows. So was another sheet cut and rolled into the shape of a boiler. So did the electric top obtain its disk-like surface. So were trolley poles made from sticks of bare alloy.

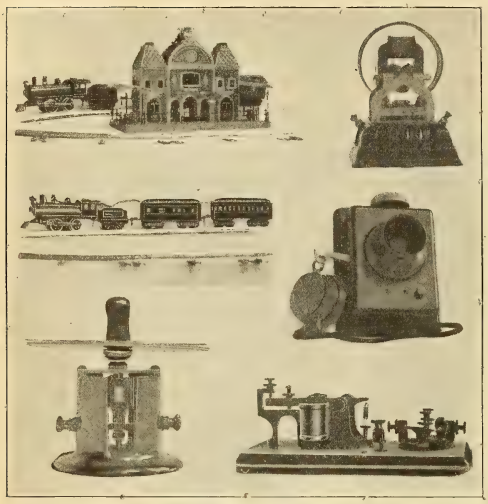
"That is the most important room in our factory," explained the foreman. "That is where the toys are shaped. Upstairs is another room where they are joined, put together. Downstairs they are painted and shipped."

Then we asked him if they made many electrical toys, and he said:

"That's all those men are doing, cutting out the pieces for electrical toys. They are very popular this year. They are cutting into the business of the Germans (at which he made a grimace the same, I swear, as old Voisin's). We are making electric toys much better than the factories at Nuremberg. Yes, that is what we call our electric room—electric machines to make electric toys. Odd coincidence, isn't it?"

"But the dolls? Do you make them, too?" I asked.

By way of reply he beckoned. I followed him up another flight of stairs. There were two doors. He opened the one that was closed. Through the other we saw all stacked up on racks electric locomotives, tops, telephones, telegraph instruments, all pieced together and only waiting the painter's brush. And like



THE ELECTRIC TOYS ARE BECOMING MORE AND MORE POPULAR

the other it was a very dirty, dusty odorous room.

Then we caught a glimpse of where the dolls were made—a glimpse sharpened by contrast. For through the just-opened door we saw a little room, its walls and ceiling painted white, its windows fresh and clean, its floors free from dust—a room, it seemed, like some quaint inn of the chateau country. And there the dolls were being joined together and dressed. On the shelves were large pasteboard boxes, filled with different articles of apparel—French apparel, dainty and new. In one box we saw tiny shoes, in another hats, in another dresses.

And such is the factory on the Rue de l'Etoile, the place whence come many of the electric toys—the place where electricity is able to bring Christmas to the children.

This year it is estimated that $5,000,000 worth of toys were imported from France alone. And it is safe to say that the biggest bill will be against those run by electricity. For, not only are they excessively popular, but their prices bring them within the reach of all.

I happened to be walking on Fifth Avenue the other day and a fashionable toy store attracted my attention. I stopped and looked in the window. I saw a train of electric cars, and looking closer I tried to assure myself that they were of the identical pattern that I had seen being manufactured on the Rue de l'Etoile. Later the manager took me around the store, explained the different types of electric toys and showed the wonderful detail with which they were made. He showed me locomotives like the steam cabs in shape, but run by current. He showed me an electric cab, an exact imitation of those used on the New York Central's suburban service. He told me that they could be run with dry batteries or from a house current (direct or alternating). When the house current is used, though, the reducer has to be employed. For 110 volts a reducer costs $6, for 220 volts $1.50 more.

He gave me his price list. Glancing through it I saw that an electric train can be bought for as low as $8.50. A locomotive, a tender and two cars with an oval track can be obtained. I saw, too, that a $65 train was equipped with an electric cab that had three pairs of driving wheels. Not only that, one could buy third rail "pay-as-you-enter" cars and overhead trolleys with control switches and batteries.

He showed me a special room in which an electric train was exhibited. It was a sort of reception hall for customers who bought on a big scale. On a huge

table in the center lay a perfect railroad system—a tunnel, a terminal, grade crossings, bridges, semaphores, block signals, switches, round houses—I forget what all. I noticed the little third rail, the storage batteries hidden behind a tin landscape. I saw the current turned on and the train go whirling through its toy world. I saw it stop to take on passengers, to take on water—which appeared rather incongruous, since the power was electricity rather than steam. I imagined children clapping their hands at the sight of it. But they would have to be children of very well-to-do fathers, for the whole system, I was told, cost $175.

But there were other electrical toys within the reach of almost all. I saw the electric top—a small motor upon whose vertical axle colored disks were placed. Then the motor began to run, and whirling around, the disks produced the constant colored confusion of a great pinwheel. Also, I was told, that with the battery the price of this top was only a dollar. Near it lay an electric telegraph outfit, a sender and a receiver on the same block of wood. And that with a battery cost only $2.50. There was a thing called an "electric thriller." This cost a dollar and the current was generated by the turning of a crank.

There was a wonderful contrivance that was called the "Electric Questioner." When the key on the left part of the board was placed on a question a pointer on the right side was run along a series of pins. When the pointer came in contact with the pin of the right answer a connection was made and a bell rang.

And so are they in all the big toy stores —electric toys attracting the most attention, inciting the most curiosity. New York is the distributing center. From Europe come the different playthings, from Paris, from Nuremberg. Salesmen begin to put them on the market with New Year's Day—almost a year before Christmas. Toy jobbers tell me that concerns of the Pacific coast are the first to order. They have their goods shipped early in spring, going by the all sea route so as to save railroad tolls. Other concerns begin to buy late in spring. By July most of them have their stock of Christmas toys—the toys electrically made and electric themselves such as we saw the tired people working upon in the Rue de l'Etoile.

Electric Light for Birds

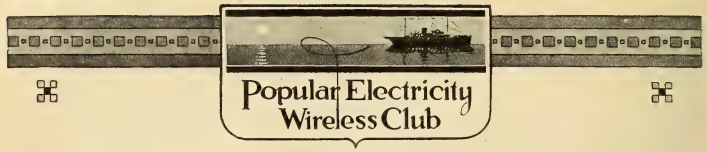
It has been found by the authorities of many zoölogical parks that one of the difficulties in maintaining their aviaries is the providing of a proper environment for birds brought from the tropics.

To warm the air to a tropical temperature is not enough. The birds demand light as well as heat. Many of them in their native homes are accustomed to feed at sunrise and again just before sunset, and their habits in this respect are seriously disturbed by the shortness of the winter days in Northern climes.

It has been found beneficial to keep aviaries containing tropical birds brilliantly illuminated in the daytime with electric light from six o'clock in the morning to six in the evening, thus closely imitating the duration of daylight to which they are accustomed in their natural habitat. The result is that they feed in the normal way, live longer and remain in better condition.

Why Thunder Is So Loud

Experiments by Professor Trowbridge, of Harvard, have shown that the astounding noise of a lightning discharge is largely due to the dissociation of water vapor, through the explosion of the hydrogen and oxygen gases produced by such dissociation. In his mimic lightning experiments Trowbridge has produced a torrent of huge electric sparks. The noise of the discharge was so great that the operator was obliged to stop his ears with cotton and then wrap a heavy cloth around them.



60,000 Meter Wave Now Possible

M. Bethenod is the chief engineer of the new Radio Electric Wireless Company, which works his patent. As an inventor he was unwilling to write about it, but as a director of the company he said the invention was not an improvement on the apparatus system of communication, but the discovery of a new principle of wireless. All scientists, he said, had been searching for a long time for a sparkless wireless. Some had succeeded, notably the American, Alexander Anderson, but the machines thus made are high frequency alternators, with which, contrary to the statement in the press, the Bethenod system has absolutely nothing to do.

M. Bethenod's apparatus is in two parts, the machine and the antennae both being special. The spark is suppressed and the oscillation produced by special machinery. An important point, which was the inventor's real object, is the production of very long waves. The difficulty with the present wireless is the short wave, with whose progress all other short waves in the atmosphere interfere. Long waves are not troubled by the short ones. The longer a wave is, the less it deteriorates. The very long waves emitted by Bethenod's apparatus are said to be completely independent of the phenomena of Nature.

Furthermore, the short waves cannot be measured mathematically. One can be measured, perhaps, but the next one cannot, owing to the depressions. Bethenod's waves are all measured mathematically. Before launching a wave he knows its mathematical measure, for he is a mathematician before everything.

Between Paris and Brussels he used the existing supports of masts and then, after testing the antennae, sent an experimental 2,000 meter wave. He next used an apparatus which allowed a 20,000 meter wave. He measured the waves and found them to be exactly what he had expected. He found communication by the long wave better than by the short one, and it is important to note that the long wave was obtained with the same antennae and supports; that is to say, at the same expense, as the short one. He was so satisfied with the results that he ordered machinery of high power, and hopes to be able to communicate from Paris to America, using 60,000 meter waves.

Can M. Bethenod's wireless messages be intercepted?

Other stations will not interfere because of their length, but if a post wishes to intercept a message that can easily be effected. Secrecy of transmission is a separate problem.

The Wireless Season

The best season of all the year for the wireless man is here—the season of clear, crisp nights, when the faint signals from far away are clearly heard in the wireless 'phones, and when the operator's mind is not confused by the unpleasant rasping noise of static.

During the last two or three months probably every one of the thousands of wireless enthusiasts in our country has been improving his outfit, or adding to it, having in mind the coming months which are especially suited for long distance work. Remembering the wonderful work of many stations last winter, it is safe to say there is not an amateur on the Pacific coast who will be satisfied with any record short of Colon, Panama, while every

eastern amateur is probably looking forward to copying the wonderful new station at the Mare Island Navy Yard, near San Francisco, Calif.

But the amateur is not alone in his expectations. In a few weeks the great 100 kilowatt installation at Washington, D. C., will be completed. Great results are also expected from the new army station at San Antonio, Texas. Regular communication between Honolulu and the Atlantic Coast is expected, via Mare Island, Calif., and Key West, Fla.

The Marconi Company's chain of stations around the world will be well under way during the coming winter.

Surely there are great pleasures, and perhaps surprises in store for the wireless enthusiast during the coming months. Here is hoping that our fondest expectations, and more, will be fully realized.

BRITISH SOLDIERS USING WIRELESS

WIRELESS IN THE MANŒUVRES OF THE BRITISH ARMY NEAR WINDSOR ON THE THAMES

It will not be the fault of training and preparation should wireless telegraphy fail to play its part in modern warfare, for every nation of accountable fighting strength is making use of it in the "practice wars" of its army. An illustration of the attention given it is shown in the accompanying picture taken at the manœuvers of the British army near Windsor on the Thames. The equipment here shown and similar ones were used to keep the infantry detachments in touch with each other as they met the onslaughts of the enemy, British cavalry. The collapsible mast is nearly ready to be shot up into the air, the soldier on the left giving his attention to the antenna and the lead-in.

Detector for Portable Set

The following is a description of a detector stand for use with portable sets. Hard rubber or fiber is preferably used for the base, which measures 2 by 3

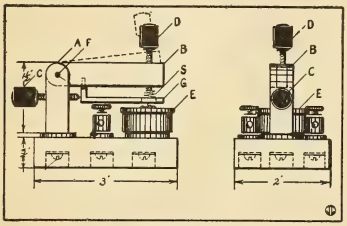


FIG. 1. SIDE AND REAR ELEVATIONS OF COMPLETE DETECTOR

by ½ inches, all holes being drilled as in Fig. 1. The upright (A) and the arm (B) are of ¼ inch square brass rod 1½ and 2½ inches, respectively. The top of the upright (A) is cut in a 180° arc or semicircle, while one end of the arm (B) is milled in the same way. A hole is drilled and tapped one-half inch from the

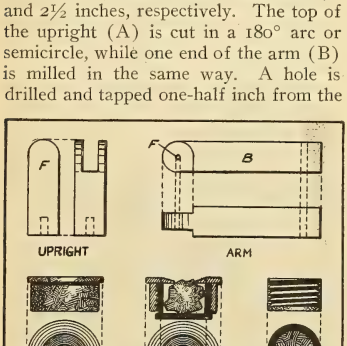


FIG. 2. DETAILS OF MINERAL CUP, UPRIGHT AND ARM

top of the standard to take the elevating screw (C), while the bottom is drilled for a base screw. A small hole is drilled in the relative position shown in Figs. 1 and 2 and designated by (F), to take a small pin. A slot as shown in Fig. 2 is now cut in the top of the upright to take the arm (B). One-quarter inch from the outer end of (B) a hole is drilled to take the tension screw (D). A small hole is drilled crosswise in the opposite end, of sufficient size to allow the pin to pass through easily. This is not the case, however, in the upright, for the pin should fit tightly.

The end of the arm through which the pin passes is milled as shown in Fig. 2, so that it fits loosely in the slot cut in the upright. The pin forms a joint which allows (B) to revolve around (A). The cup (E) is turned from one inch brass and is composed of two parts, Fig. 2, the cup which contains the crystal, and the cap which holds the crystal in place. The cup is turned to ¾ inch outside diameter and ½ inch inside diameter and is ½ inch high. It is threaded to within ⅛ inch of the bottom. The cap measures 1 inch (outside diameter) and is turned to the proper size for threading on the inside to fit the cup. A rim is turned on the top of the cap as shown, Fig. 2. A hole is drilled and tapped slightly off center in the base so that the spring shown in Fig. 2 (S) will cover more of the surface of the crystal than it would if the cup were fastened through the center. The coiled spring should be of No. 40 copper wire if galena is used, for the lightest possible contact is necessary with this mineral. The spring is soldered to the tension screws. (G) is a piece of ⅛ inch brass ½ inch wide, bent at one end as in Fig. 1. Before being bent, however, this piece is turned down until it forms a ⅛ inch threaded rod for a distance of a little over ⅛ inch. A small hole is drilled in the arm to receive this piece, which is screwed down until it is in the position shown in Fig. 1. A hole of sufficient size to allow the free passage of the coiled spring is drilled through the opposite end. All holes with the exception of the above mentioned are drilled with a No. 23 drill and tapped with an 8-32 tap. Two binding posts are put in place and the detector assembled.

—Jesse Jay.

An Efficient Wireless Set

The following is a description of a practical and efficient wireless set: The aerial of this set is composed of six guy wires. The six wire aerial is of the "straightaway" type, connections being shown in Fig. 1. The sending set consists of a closed core 2-kw. transformer, an oil immersed glass plate condenser, an

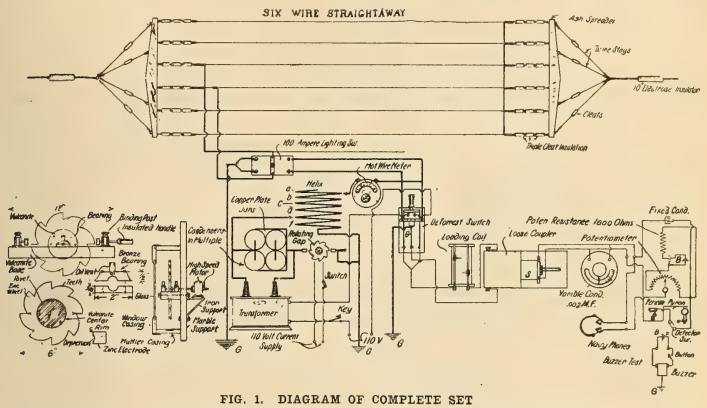


FIG. 1. DIAGRAM OF COMPLETE SET

strands of No. 12 aluminum wire of as near 150 feet in length as conditions will allow. Eight-foot spreaders are used, preferably of ash or bamboo, for the six wires, and are insulated by a double row of glazed porcelain cleats between each spreader and the aerial wires. The suspension ropes are insulated with two ten-inch Electrose insulators, as shown in Fig. 1. The aerial is supported by a 44-foot pole consisting of a sixteen-foot 2 by 4, a sixteen-foot 2½ by 2½, and a twelve-foot 2 by 2 bolted together with a two-foot overlap, the whole being braced by eight No. 12 galvanized iron

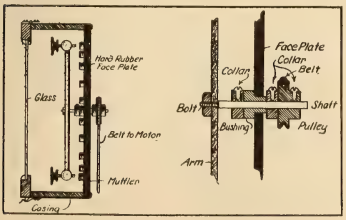


FIG. 2. ROTARY SPARK GAP

inductive helix, a hot wire meter, a rotary spark gap, and a heavy contact key. The rotary spark gap used in connection with this set is shown in Fig. 2, and is used with any high speed motor operating on 110 volts a. c. or d. c. An efficient receiving set, which gives excellent results in long distance work, is the one described in the June issue, page 190, and

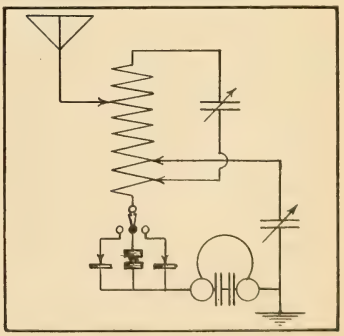


FIG. 3. RECEIVING HOOK-UP

shown in Fig. 3. This set consists of a triple slide bare wire tuner, two galena and a silicon detector, navy type phones, a fixed condenser in steps, and two rotary variable condensers. A compact way of mounting a complete set using a receiving set as shown in Fig. 3 is illustrated in a front elevation view, Fig. 4.

The aerial switch used in this set is

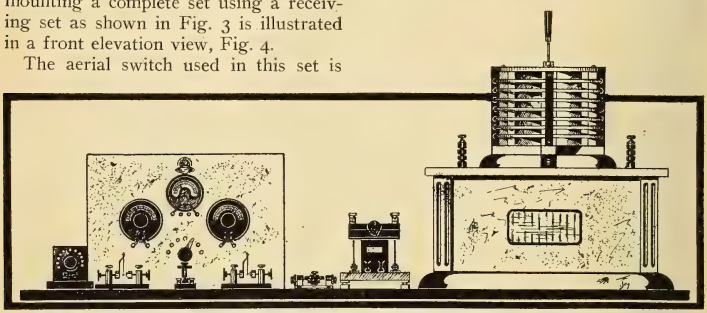


FIG. 4. FRONT ELEVATION OF COMPLETE SET

of the De Forrest type with the disconnecting ground. An emergency gap and muffler are shown in the helix in Fig. 4, and are used in case of a breakdown of the rotary. For general efficiency this set has a proven value.—Jesse Jay.

Effect of Ionization on Wave Propagation

Does the velocity of electric waves through the air increase with ionization? Dr. W. H. Eccles of the British Royal Society answers this question in the affirmative. The natural electric wave train which radiates from a lightning discharge produces a disturbance in the apparatus for reception of wireless telegraph messages. Normally these disturbances form a steady stream of faint or loud clicks in the receiving telephones. The rate at which they are received at a station varies from hour to hour during the 24 hours, and also with the season. As a general rule, however, the disturbances—or "strays" as they are often called—heard at night are stronger and more frequent than those heard in the day. The change from day to night and from night to day conditions is very striking just at sunset and sunrise.

It is chiefly this period of transition that is investigated by Dr. Eccles. He found that very often there is an absence of the gradual transition that might be expected, but instead there is a passage through a sharply marked minimum.

In order to explain these phenomena, Dr. Eccles develops a hypothesis which is based on the proposition to the effect that the velocity of electric waves through ionized air increases with increasing ionization. Now the ionization produced by solar radiation increases within limits, with the increase of the height in the atmosphere.

From this it follows that a system of waves with vertical wave fronts must suffer a forward tilting of the wave fronts as it traverses the heterogeneous medium, and the rays will follow curved trajectories which have their concavity downwards. This alone explains many of the hitherto unexplained phenomena of wireless telegraphy.

To explain, however, the stray minima found at sunset and sunrise, it is necessary to suppose that the process of ionization of the atmosphere at sunrise, and the process of de-ionization at sunset, form a turbulence in the medium that leads to difficulty of propagation.— Dr. L. K. Hirshberg.

How to Comply With the New Wireless Law

Standard Experimental Equipment in Accordance with Regulations

By PHILIP E. EDELMAN

Part II.—Transmitting Condenser

In order to standardize experimental apparatus, the author considers that the parallel plate type of condenser immersed in an insulator to prevent surface leakage is the best to adopt because the capacity can be readily calculated. The formula is,

$$C=\frac{KA}{4\pi D} \text{ C. G. S. electrostatic units, in}$$

which C represents the capacity, K the dielectric constant (see table), A the area of one of the plates overlapped by the other plate, and D the distance apart of the plates, in centimeters. The formula is only applicable to ordinary condensers in which the distance between the plates is relatively small in comparison with the length and breadth of the plates. This will be simplified by stages as with the wave length formula.

To express the capacity direct in microfarads, the formula is

$$C=\frac{KA}{4\pi D\times 9\times 10^5} \text{ or } KA=C4\pi D\times 9\times 10^5$$

In order to find the desired area, this may be arranged,

$$A=\frac{36\pi DC\times 10^5}{K}$$

Now the quantity $36\pi\times 10^5$ is the same in every case, so that the formula may be simplified to

$$\text{Formula, } A=\frac{DC\times 11309760}{K}$$ and when

glass is used for the dielectric, which has a constant of eight, this may be further simplified to

$$A=DC\times 1413720 \text{ because } \frac{11309760}{8}=1413720.$$

DIELECTRIC TABLE FOR CONSTANTS K

(Air, empty space, or gases at atmospheric pressure, 1.)

Glass	6	to	10
Light flint glass	6.5		
Dense flint glass	6.5	to	10
Hard crown glass	7		
Mica	6.6	to	7.5
Hard rubber	2.7		
Kerosene oil	2		
Castor oil	4.78		
Shellac	2.7	to	3.5
Ebonite	2.5	to	3
Manilla paper	1.5		
Paraffin	1.75	to	2.3
Resin	1.77	to	2.5
Porcelain	4.38		
Water	.80		

Note.—An average result is best to use in the formula. Glass should be taken as 7½ or 8 when ordinary glass or old photographic plates are to be used. The emulsion should be cleaned off before using the latter.

The calculation is thus very simple. The figures are in the metric system and to change to inches after the area has been found in square centimeters, change the ratio.

One inch is equal to 2.54 centimeters. One centimeter is equal to .3937 inch.

One square inch equals 6.45 sq. cm. One sq. cm. equals .1550 sq. in.

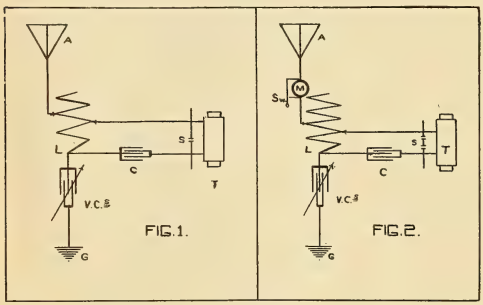
To illustrate the use of the formula. Find the necessary area for the tinfoil to make up a condenser of .002 microfarad capacity, using glass 0.1 centimeter thick. Ordinary glass plates are approximately .125 centimeter thick. Using the simplified, we get,

$$A=.1\times .002\times 1413720=282.74 \text{ sq. cm.}$$

Now this surface can be apportioned in almost any desired manner. For instance, three plates of glass of this size and 12x14 centimeters with tinfoil on each side, 9x10½ centimeters would be approximately right. Almost any desired capacity can be worked out to a fairly close degree of accuracy in this manner. If either of the three factors, A, D or K, is desired, the other two must be known.

(Copyright, 1912, by Philip E. Edelman)

In designing a condenser for transmission purposes the thickness of the dielectric used must be sufficient to withstand the impressed voltage as well as an overload without puncturing. For this reason a thickness of one centimeter for every 40,000 volts should be allowed. Thus for 10,000 volts the dielectric should be .25 centimeter thick, and so on. If glass can not be had which is large enough, two or more capacities of the same size can be connected in series or series multiple to care for the voltage without breaking down. This method cuts down the capacity, however, so that larger units must be used. Thus if two condensers are used in series to secure a capacity of .2 microfarad, each must have a capacity of .4 microfarad, and so on. When parallel connections are used the capacity increases directly, but the puncture voltage must be considered for the weakest unit. Thus two condensers of .4 microfarad capacity each connected in parallel will give a capacity of .8 microfarad. It is of the greatest importance that the condenser be constructed with care, and that the coatings should have sufficient capacity, leakage be avoided, connections of large capacity, and so on. Thin sheets of copper or aluminum are preferred to tinfoil, though the latter may be used if of large size. Transformer or boiled linseed oil should be used to cool the condenser and to prevent brush discharges. The glass used should be very clean and free from lead. It should also be of uniform size throughout.



A—AERIAL. L—INDUCTANCE. C—CONDENSER. S—SPARK GAP. T—TRANSFORMER. G—GROUND. V.C.s—VARIABLE CONDENSER. M—HOT WIRE AMMETER. Sw—SHORT CIRCUITING SWITCH

It was stated that the wave length could be lowered by a series capacity in the aerial. The method is illustrated in Fig. 1, and a variable or variable step condenser is preferable for the purpose. The method is only of value, however, when a wave meter may be had for measuring the transmitting wave length. It is interesting to note, however, that it can be made to serve with aerials already installed and in use. The transmitting range will be cut down by this arrangement, and it is valuable more as an experiment than anything else. When the primary circuit is calculated a hot wire ammeter can be used, as will be seen later.

CALCULATION OF INDUCTANCE.

Like wave length and capacity, it is easy to calculate inductance, when the simple formulas which follow are used.

The formula for cylindrical coils of one layer, as helices or choke coils, taking variable factors into consideration, is

$$\frac{(5\times D\times T)^2}{M+\frac{1}{3}D}=\text{inductance in centimeters}$$

D is the diameter of the coil in *inches*.

T is the total number of turns of wire.

M is the length of the coil in inches.

While the result is expressed in centimeters, it may be changed to microhenrys by dividing by 1,000.

As an illustration: Suppose we wish to find the inductance of a helix or choke coil which is nine inches in diameter, ten inches long and is composed of a total of ten turns of wire. By using

the above formula for inductance we would substitute these values as follows:

$$\frac{(5\times9\times10)^2}{10+3}=\frac{450^2}{13}$$

or 15.580 cm. approximately, or 15.580 microhenrys.

The formula for the inductance for a flat or pancake coil or helix (the kind with several layers wound over each other), is

$$\frac{(5\times D\times T)^2}{\frac{1}{3}D+\frac{9}{2}M+\frac{9}{4}N}=\text{Inductance in centimeters.}$$

D is the average diameter of the coil in inches.

M is the length of the coil in inches.

N is the depth of the coil in inches.

T is the total number of turns of the coil.

For example: Find the inductance of a flat type of helix of the dimensions: six turns of copper strip one inch apart, the strip being one inch wide, depth of winding six inches, and average diameter twelve inches. (Inside six inches, outside eighteen inches.)

$$\frac{(5\times12\times6)^2}{4+1\frac{1}{2}+7\frac{1}{2}}=\frac{(360)^2}{13}=\frac{129{,}600}{13}$$

or 9970 centimeters or 9.970 microhenrys.

Now from the foregoing it should be possible to calculate the inductance of any helix or oscillation transformer which you may have, so that you will know where you are at. In the case of an oscillation transformer the primary and secondary are calculated separately, though the primary is all that it is essential to know, since the actual tuning is best carried out by the use of a hot wire ammeter. That is, the object is to calculate the primary or condenser circuit for a wave length of 200 meters, using an efficient capacity of the proper size for the given coil or transformer, and then to bring the secondary or antenna circuit to resonance by using a hot wire ammeter or other indicator. In calculating the inductance, the separate turns must be considered independently for accuracy, particularly when a pancake type of coil is used. Thus starting with the outer turns, calculate the inductance for the first two turns as if they formed the coil alone, then the first three, the first four, and so on, or vice versa, starting from the inner turns.

The law requires that the transmitted wave be *pure* and *sharp*. This means that both the primary and secondary circuits must be brought to resonance, that the connections between the apparatus must be good, that heavy wire be used for the connections, and that the helix or oscillation transformer used be of a construction which allows easy and accurate variation. Now small stations will find the close coupling resulting from a helix an advantage because of the increased intensity of signals, but as the double wave which results from an ordinary spark system is not sharp or in compliance with the law unless the circuits are nicely adjusted, this item is of great importance. The use of an oscillation transformer is therefore to be preferred, as the variable coupling allows of sharper tuning. *Untuned or poorly tuned stations do not comply with the law.*

Without considering the details on account of the lack of space, the following standards are suggested for a helix and oscillation transformer.

STANDARD HELIX.

Seven complete turns of No. 4 B. & S. brass or aluminum wire are wound on a form ten inches in diameter and spaced three-fourths of an inch apart. About 19½ feet are necessary. This standard helix has a maximum inductance of 30.28 microhenrys, which is even more than is ever needed for an average station with a 200 meter wave length. The inductance of a single turn is approximately .618 microhenry, that of three turns 9x.618, that of 3½ turns, 12¼x.618, and so on, since the inductance increases as the square of the number of turns.

STANDARD OSCILLATION TRANSFORMER.

Pancake type. Recommended when over 100 watts of energy are used. Use

½ inch brass ribbon about 1-16 inch thick. The primary and secondary are wound as a spiral, the primary having five complete turns and the secondary nine complete turns. The turns for both the primary and secondary coils are spaced exactly ½ inch apart and begin ¼ inch in from the outside edge of the support arms. The secondary coil will thus end nearer the center than the primary. The support strips are 14½ inches long and ¾x½ inch, with slots for the ribbon. The two coils are mounted so that they are adjustable with respect to each other. Clips should be provided for both coils. The maximum inductance of the primary coil is approximately 13½ microhenrys when all the turns are used. Beginning with the outside turn the values are approximately: First turn, .868 microhenry; first two turns, 3.97 microhenrys; first three turns, 5.7 microhenrys; first four turns, 10.25 microhenrys. (Formula 2).

SPARK GAP.

While a minor item as far as wave length and tuning is concerned, the spark gap should not be overlooked as it determines the efficiency and damping of the set to a large extent. The use of a series gap with perforated faces, or a rotary series gap is recommended. While a simple non-cooled gap can be used, it is less efficient and satisfactory and should not be adopted when other and better types are to be had. A quenched gap is also very desirable, as the best waves are avoided by its use. Any of the three types when well constructed with regard to efficiency and durability will serve as a satisfactory standard.

OPERATING.

The minor instruments have not been mentioned, but the key, switches, wiring, kickback prevention, lightning protection switches, and so on should not be neglected and should be installed in approved form.

The hot wire ammeter is essential if the tuning idea suggested in this article is to be efficiently carried out. This instrument is quite simple and can either be purchased or constructed, but can hardly be omitted. With the apparatus connected up, the tuning is carried out by adjusting the spark length so that the spark is neither mushy or stringy, (with leakage transformers, the adjustment of the primary circuit by the use of more or less leakage is used to cooperate with the adjustment at this point), the helix or oscillation transformer is then included in the primary or condenser circuit, using a number of turns which will give the inductance necessary in connection with the condenser to produce the desired wave length of 200 meters, as per the foregoing calculations, and then the secondary or antenna circuit is adjusted by using the hot wire ammeter as an indicator. More or less turns are included in the secondary circuit until the hot wire ammeter indicates a maximum radiation for the given wave length of 200 meters. The spark gap should then be further adjusted, leaving the rest of the connections alone, until a maximum radiation is indicated. If these operations are carried out carefully, the station will be adjusted to its maximum efficiency for the given 200 meter wave length. If the condenser is altered, the whole operation must be repeated with the new value for the capacity.

Figure 2 shows how a large aerial can be used for experimental purposes to produce a 200 meter wave length. The primary circuit is adjusted as before, but the secondary circuit is adjusted by increasing or decreasing the series capacity until the maximum radiation is indicated for both the series capacity and secondary inductance adjustments. Many experimenters will very likely be able to use this method without erecting a smaller aerial. If the aerial is very large, this method will probably be of little use.

In either case, the tuning can then be further carried out in the case when a transformer is used instead of a helix, by

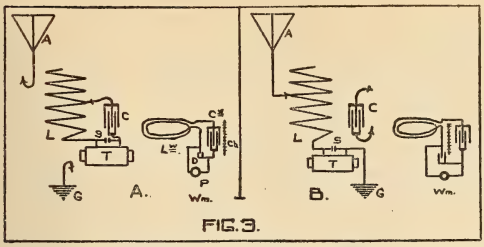


FIG. 3.

A—AERIAL. L—INDUCTANCE. G—GROUND. S—SPARK GAP. C—CONDENSER. T—TRANSFORMER. Wm—WAVE METER. Lw—INDUCTANCE. Cw—CONDENSER WITH SCALE Cb. D—DETECTOR. P—TELEPHONE

varying the coupling between the primary and secondary circuits. While a small degree of coupling means very sharp tuning, this should not be carried too far, as the intensity of the transmitted impulses is less with a small coupling. This may also be carried out in a small way with a helix provided with adjustable clips for the terminals of both condenser and aerial circuits. The circuits are not properly tuned until the maximum radiation is indicated and since the primary circuit is fixed at 200 meters, the secondary circuit is very nearly at this same value when in resonance with it.

A wave meter is nothing but a simple condenser and inductance of known value connected in series. While the construction is very simple, the instrument is of little or no value unless calibrated, and since this is best accomplished by comparison with a calibrated instrument, the readers are not advised to construct one unless a calibrated wave meter may be had for comparison. A calibrated rotary plate variable condenser in series with two to four turns of No. 18 bell wire wound on a form nine inches in diameter may be used. When the wave meter is available the calculations for the circuits are hardly necessary, and, at any rate, they may be checked up. The method of using a wave meter is indicated in Fig. 3. A telephone receiver and detector can be made to serve as an indicator for experimental purposes. The inductance of the wave meter is placed in a parallel plane with the helix as shown, but not too near, and the wave length of the primary measured with the aerial and ground disconnected as shown. The adjustment which gives a 200 meter wave length should be noted. Now disconnect the condenser and connect in the aerial and ground as shown at B of the figure, and adjust the inductance or the antenna circuit until the wave meter responds most efficiently when fixed at 200 meters.

This idea can be nicely carried out with the arrangement of Fig. 1, and will show whether or not the aerial can be used with a series capacity to give a 200 meter wave length. The connections are then made with the amount of inductance for both circuits which was indicated as the proper amount. The transmitted waves will then be very nearly 200 meters on each of the two wave peaks.

A less reliable method of calibrating the wave meter is to calculate the primary circuit for a 200 meter wave length and to mark the adjustment of the wave meter's condenser which gives a maximum indication for the given circuit. The secondary circuit can then be adjusted to give a maximum indication in the wave meter with the capacity left at the previous adjustment.

RECEIVING.

The receiving station needs no special comment. A loose coupling will be practically essential for tuning purposes for the reasons already set forth. Both long and short distance receiving may be carried on as before except that the secrecy of messages must be preserved and that a license is necessary in order to receive interstate messages; that is, those coming from another state.

Eclipse of the Sun Affects Wireless Signals

In *L'Electrician* of May 31, M. Schederman gives an account of the intensity of the signals received at the wireless station at Copenhagen, Denmark, which was in constant communication with the station at Blaavands Huk, on the North Sea, situated at a distance of about 180 miles, during the eclipse of the sun on April 17 of this year.

The variations in the intensity of the sounds heard at Copenhagen were very considerable, and while they could easily be made imperceptible by placing a small resistance between the binding screws of the receiver, and by loosening any of the connections as long as the eclipse was not far advanced, they became gradually stronger, and at the time of maximum eclipse they were so strong that even putting the receiver in short circuit and loosening the connections did not sensibly diminish them. After that the intensity became gradually normal, in proportion as the disk of the sun reappeared. Seeing that the other station, 180 miles away, was sending waves of constant power at regular intervals during the whole duration of the eclipse, it follows that the variations in the strength of the signals received must have been entirely due to modifications in the ether conductivity.

In a communication to the Academy of Sciences (France), M. Rothe says that it is well known that the intensity of the reception of radio-telegrams is greater it is frequently doubled between noon and midnight. This difference is attributed to the effects of the rays of the sun; disturbances are observed also at sunrise and at sunset. In attempting to explain these phenomena by a study of the action of the radio-telegraph during the eclipse, it was found that there was a relation between the eclipse, the lowering of the air temperature, the movement of the wind resulting from this, and the intensity of the wireless signals, which were found to be augmented during the eclipse.

Directory of Wireless Clubs

This directory of amateur wireless clubs and associations will be published each month. When a new club is formed the names of the officers, also the street address of the secretary, should be forwarded to us at once. Any changes that should be made in the directory, when designated by an official of a club, will be made in the next issue after receipt of such advice.

Aerogram Club.—J. Stedman, President; A. Hayward Carr, Chairman Board of Directors; Albert S. Hayward, Treasurer; Donald P. Thurston, Secretary; Walter B. Clarke, 17 May St., Newport, R. I., Corresponding Secretary.

Aerograph Club of Richmond, Ind.—H. J. Trueblood, President; Richard Gatzek, Vice President; James Pardieck, 320 South 8th St., Richmond, Ind., Secretary.

Aero Wireless Club.—A. Garland, President; W. Ladley, Vice President; D. Beard, Napa, Calif., Secretary and Treasurer.

Allegheny County (Pa.) Wireless Association.—Arthur O. Davis, President; Theodore D. Richards, Vice President; James Seaman, Leetsdale, Pa., Secretary and Treasurer.

Alpha Wireless Association.—L. L. Martin, President; F. A. Schaeffer, Vice President; G. F. Girton, Box 57, Valparaiso, Ind., Secretary and Treasurer.

Amateur Wireless Association of Schenectady, N. Y.—D. F. Crawford, President; L. Beebe, Vice President; C. Wright, Treasurer; L. S. Uphoff, 122 Ave. "B," Schenectady, N. Y., Secretary.

Amateur Wireless Club of Geneva (N. Y.).—H. Graves, Jr., President; C. Hartman, Vice President; L. Reid, Treasurer; Benj. Merry, 148 William St., Geneva, N. Y., Secretary.

Arkansas Wireless Association.—G. A. Rauch, President; Edward Vaughn, 2622 State St., Little Rock, Ark., Secretary and Treasurer.

Berkshire Wireless Club.—Warren A. Ford, President; William Yarkee, Vice President; Charles Hodecker, Treasurer; Jas. H. Ferguson, 18 Dean St., Adams, Mass., Secretary.

Canadian Central Wireless Club.—Alexander Polson, President; Stuart Scorer, Vice President; Benj. Lazarus, P. O. Box 1115, Winnipeg, Manitoba, Can., Secretary and Treasurer.

Cardinal Wireless Club.—K. Hithers, President; F. Dannenfelser, Vice President; Miss A. Peterson, South Division High School, Milwaukee, Wis., Secretary.

Chester Hill Wireless Club.—Waller Morgan, President; Richard D. Zucker, 46 Clinton Place, Mt. Vernon, N. Y., Secretary and Treasurer.

Chicago Wireless Association.—F. V. W. ReQua, President; S. W. Wooster, Vice President; C. Stone, Treasurer; F. D. Northland, Secretary; R. P. Bradley, 4418 South Wabash Ave., Chicago, Ill., Corresponding Secretary.

Colorado Wireless Association.—William Cawley, President; Thomas Ekren, Vice President; W. F. Lapham, 1545 Milwaukee St., Denver, Colo., Secretary-Treasurer.

Custer Wireless Club—Franklin Webber, President; Fred Cross, Vice President; Oakley Ashton, Treasurer; Walter Maynes, 438 Custer Ave., Los Angeles, Cal., Secretary.

De Kalb Radio-Transmission Association.—Bruce Lunberg, President; Walter Bergendorf, Vice-President; De Estin Snow, Treasurer; Bayard Clark, 205 Augusta Ave., De Kalb, Ill., Secretary.

Fargo Wireless Association.—Kenneth Hance, President; John Bathrick, Vice President; Earl C. Reineke, 518 9th St., Fargo, N. D., Secretary.

Forest Park School Wireless Club.—W. S. Robinson, Jr., President; William Crawford, R. F. D. No. 1, Springfield, Mass., Secretary.

Frontier Wireless Club.—Franklin J. Kidd, Jr., President; A. Donald Allerbury, 1034 Elmwood Ave., Buffalo, N. Y., Secretary-Treasurer.

Geneva Wireless Club.—Charles B. Hartman, President; Charles Smith, Vice-President; Benjamin Merry, Treasurer; Henry B. Graves, Jr., 448 Castle St., Geneva, N. Y., Secretary.

Gramercy Wireless Club.—James Platt, President; John Gebhard, Vice President; John Diehl, Treasurer; John Jordan, 219 East 23d St., New York, N. Y., Secretary.

Granby High School Electricity Club.—Harold Taylor, President; Stuart Bliss, Vice President; Eastman Smith, Granby, Mass., Secretary-Treasurer.

Greenfield Wireless Association.—Edward M. Wolfe, President and Corresponding Secretary, 4125 Haldane St., Pittsburgh, Pa.

Hannibal (Mo.) Amateur Wireless Club.—Charles A. Cruicksbank, President; J. C. Rowland, Vice President; William Youse, treasurer; G. G. Owens, 1306 Hill St., Hannibal, Mo., Secretary.

Harriman Wireless Association.—Oswald L. Fillmore, President; Everett R. Parish, 801 Clinton St., Harriman, Tenn., Secretary.

Haverhill (Mass.) Wireless Association.—Riedel G. Sprague, President; Charles Farrington, Vice President; Leon R. Westbrook, Haverhill, Mass., Secretary and Treasurer.

Hobart Wireless Association.—Asa Bullock, President; Charles Clifford, Hobart, Ind., Secretary.

Independence Wireless Association.—Boyce Miller, President; Ralph Elliott, Secretary; Joseph Mahan, 214 South Sixth St., Independence, Kan., Vice President.

Independent Wireless Transmission Co.—Harlan A. Eveleth, 72 Gray St., Arlington, Mass., Secretary.

Jonesville Wireless Association.—Frederic Wetmore, President; Webb Virmylia, Vice President; Richard Hawkins, Treasurer; Merritt Green, Lock Box 82, Jonesville, Mich., Secretary.

Lake View Wireless Club.—E. M. Fickett, President; R. Ludwig, Treasurer; R. F. Becker, 1439 Winona Ave., Chicago, Ill., Secretary.

Lane Technical High School Club.—B. C. Lizenby, President; C. I. Gringrich, Vice President; C. H. Stone, Treasurer; J. Simon, Secretary; R. R. Traub, Lane Technical High School, Chicago, Ill., Corresponding Secretary.

Lexington Aerogram Company.—Roger H. Preston, President; Francis Dean, Vice President; Charles Young, 5 Warren St., Lexington, Mass., Secretary.

Long Beach Radio Research Club.—Bernard Williams, 555 E. Seaside Bvd., Long Beach., Calif., Secretary.

Manchester (N. H.) Radio Club.—Homer B. Lincoln, President; Clarence Campbell, Vice President; Elmer Cutts, Treasurer; Earle Freeman, 759 Pine St., Manchester, N. H., Secretary.

New Haven Wireless Association.—Roy E. Wilmot, President; Arthur P. Seeley, Vice President; Russell O'Connor, 27 Vernon St., New Haven, Conn., Secretary and Treasurer.

New Thomson Wireless Club.—T. Frank Edwards, President; C. D. Fitzgerald, Vice President; Edward M. Fleming, care the New Thomson, Kane, Pa., Secretary.

Northwestern Wireless Association of Chicago.—Rolf Rolfson, President; H. Kunde, Treasurer; Edw. G. Egloff, 2729 Noble Ave., Chicago, Ill., Recording Secretary.

Oakland Wireless Club.—H. Montag, President; W. L. Walker, Treasurer; W. R. Sibbert, 916 Chester St., Oakland, Calif., Secretary.

Oklahoma State Wireless Association.—T. E. Reid, President; G. O. Sutton, Vice President; Ralph Jones, Box 1448, Muskogee, Okla., Secretary and Treasurer.

Oregon State Wireless Association.—Charles Austin, President; Joyce Kelly, Recording Secretary; Edward Murray, Sergeant-at-Arms; Clarence Hischoff, Lents, Ore., Treasurer and Corresponding Secretary.

Peterboro Wireless Club.—G. B. Powell, President; C. V. Miller, Vice President; E. W. Oke, 263 Engleburn Ave., Peterboro, Ontario, Can., Secretary and Treasurer.

Plaza Wireless Club.—Paul Elliott, President; Myron Hanover, 156 E. 66th St., New York, N. Y., Secretary and Treasurer.

Pueblo Wireless Club.—L. R. Finke, President; B. C. Howe, Treasurer; K. G. Hermann, 100 Board of Trade, Pueblo, Colo., Secretary.

Radio-Signal Club of Chicago.—W. E. White, President; G. C. Schade, Vice President; F. H. McCarthy, 2113 Washington Bvd., Chicago, Ill., secretary and treasurer.

Rockland County Radio Wireless Association.—M. V. Bryant, President; H. I. Sprott, Treasurer; P. Haeselbarth, Nyak, N. Y., Secretary.

Roslindale (Mass.) Wireless Association.—O. Gilus, President; E. T. McKay, Treasurer; Fred C. Fruth, 962 South St., Roslindale, Mass., Secretary.

Sacramento Wireless Signal Club.—E. Rackliff, President; J. Murray, Vice President; G. Banvard, Treasurer; W. E. Totten, 1524 "M" St., Sacramento, Calif., Secretary.

Santa Cruz Wireless Association—Orville Johnson, President; Harold E. Senter, 184 Walnut Ave., Santa Cruz, Calif., Secretary and Treasurer.

Seneca Electrical Club.—Neil A. Stillman, President; Maurice P. Whitney, Vice President; Harold Server, Treasurer; Howard Donnelly, R. F. D. 1, Geneva, N. Y., Secretary.

Southeastern Indiana Wireless Association.—R. F. Vanter, President; D. C. Cox, Vice President and Treasurer; H. Hitz, Fairmont, Madison, Ind., Corresponding secretary.

Southern Wireless Association.—B. Oppenheim, President; P. Gernsbacher, 1435 Henry Clay Ave., New Orleans, La., Secretary and Treasurer.

Springfield (Mass.) Wireless Association.—A. C. Gravel, President; C. K. Seely, Vice President and Treasurer; D. W. Martenson, Secretary; Club Rooms, 323 King St., Springfield, Mass.

Spring Hill Amateur Wireless Association.—R. D. Tilley, President; H. P. Hood, 2nd, 2 Benton Road, Somerville, Mass., Secretary and Treasurer.

St. Paul Wireless Club.—E. C. Estes, President; W. P. Husby, Vice President; T. J. Taylor, Treasurer; L. R. Moore, 1911 Ashland Ave., St. Paul, Minn., Secretary.

Tri-State Wireless Association.—C. B. DeLa-Hunt, President; O. F. Lyons, Vice President; T. J. M. Daly, Treasurer; C. J. Cowan, Memphis, Tenn., Secretary.

Waterbury Wireless Association.—Arthur E. Hapeman, President; Walter Lowell, Treasurer; H. M. Rogers, Jr., 65 Elizabeth St., Waterbury, Conn., Secretary.

Wireless Association of British Columbia.—Clifford C. Watson, President; J. Arnott, Vice President; E. Kelly, Treasurer; H. J. Bothel, 300 Fourteenth Ave. E., Vancouver, B. C., Corresponding Secretary.

Wireless Association of Canada.—W. Fowler, President; E. G. Lunn, Vice President; W. C. Schuur, Secretary and Treasurer.

Wireless Association of Fort Wayne.—Adolph Rose, 1326 E. Wayne St., Fort Wayne, Ind., President and Secretary.

Wireless Association of Montana.—Roy Tysel, President; Elliot Gillie, Vice President; Harold Satter, 309 South Ohio St., Butte, Mont., Secretary.

Wireless Association of Savannah.—P. C. Bangs, President; A. A. Funk, Vice President; H. Jenkins, Treasurer; L. H. Cole, Cor. Liberty and Price Sts., Savannah, Ga., Secretary.

Wireless Club of Baltimore.—Harry Richards, President; William Pules, Vice President; Curtis Garret, Treasurer; Winters Jones, 728 North Monroe St., Baltimore, Md., Secretary.

Wireless Club of the Shortridge High School.—Robert C. Schimmel, 2220 N. Penn St., Indianapolis, Ind., President; George R. Popp, Vice President; Leonard Brill, Treasurer; Oliver Hamilton, Secretary.

Y. M. C. A. Wireless Club of Williamsport, Pa.—Lewis Holtzinger, President; Christian Cupp, Vice President; Robert Templeman, Treasurer; Lester Lighton, 211 W. 4th St., Williamsport, Pa., Secretary.

Zanesville Wireless Association.—Charles S. Shryock, President; Rudolph C. Kamphausen, 105 South Seventh St., Zanesville, Ohio, Secretary-Treasurer.

For Practical Electrical Workers

Construction of a 50 Watt Dynamo

By CHAS. F. FRAASA

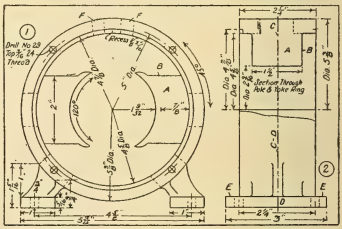
PART I.—FIELD MAGNETS, ENDPLATES, PATTERN MAKING AND MACHINING

The following design is for a dynamo of 50 watts output at 2400 revolutions per minute. Data is given for winding for either shunt or series excitation at 25 volts and two amperes, or ten volts and five amperes. The machine will run well as a motor, but at a lower speed at the above voltages. To secure 2400 r.p.m., the voltage would have to be raised.

There are so many foundries producing excellent castings at reasonable cost that the use of castings should cause the builder no difficulty.

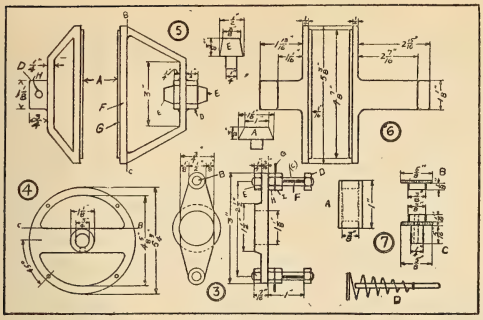
Pattern making. The patterns are constructed of ¼ inch white pine glued together to the proper thickness with pattern maker's glue. Patterns to be turned are glued to a piece of one inch plank fastened to the lathe faceplate, after first gluing a piece of thick paper between the pattern and the piece of wood on the faceplate. All patterns should taper slightly from the parting line, making sections thicker at the parting so that the pattern may be removed without tearing the mould. The castings are most too small to make any practical allowance for shrinkage but about ⅛ inch or more must be allowed all finished surfaces for machining. All sharp corners should be carefully rounded out with fillet. Remember that the dimensions given are finished dimensions.

The field magnet is dimensioned in Figs. 1 and 2. The top half of Fig. 2 is a section through the field showing the shape of the poles and the yoke ring. The poles (A) should be rounded off on the four edges (B). The pattern divides along the line (CD). The two parts are fastened together by 3/16-inch dowel pins located by inscribing a five inch diameter circle on each half of the pattern. With the two parts connected in this way, the field ring or yoke may be turned and bored. Remove the



ring from the faceplate, and locate the pole pieces (A) Figs. 1 and 2. The pole pieces and the base lugs (E) are built up from quarter inch pine. Each part is fastened with glue by a projection as indicated by the dotted lines in the field ring in slots cut in the ring. Be sure to allow ⅛ inch all around the face of the pole pieces for boring.

The brush holder pattern is made in one piece as illustrated in Fig. 3. Drill a hole in the center of the round portion



of the brush holder to receive the dowel of the core print (A), which should be fastened with glue.

The patterns for the bearing and end plates, Figs. 4, 5 and 6, are made in one piece, since the parting line is the inside of the pattern and the edge (A), Fig. 5. The main portion is built up and turned, inside and out. Then saw away the portion on both sides of the bearing, by sawing along the lines (BC), Figs. 4 and 5. Then turn up the hub (D) and the core prints (E) and glue them in place. The bearings are cored ½ inch in diameter. In making these patterns, make the part (F) 7/16 inch thick, allowing ⅛ inch for machining and 1/16 inch for the bearing bracket ring (G), which is not turned in the pattern but in the casting when finished.

Machine work. When you receive your castings from the foundry, carefully clean them with a file and emery cloth or a grind wheel. Strap the field magnet to the faceplate and bore the armature tunnel to 2 9/16 inches in diameter. Face the end of the field magnet yoke and turn the recess for the ring on the end plates. To center the field casting when turning the other end of the yoke, turn up a supplementary faceplate having an elevated portion to snugly fit the recess in the end of the yoke. Then strap the casting on this and face the other side of the yoke and turn the recess. The base should then be filed and ground to shape. Drill the two ⅜ inch holes (F), Fig. 1, in the top of the field magnet casting for the terminal connection binding posts.

Probably the best method of machining the end plates is to chuck the end plate, and bore the hole for the bearing bushing ¾ inch in diameter and then mount the end plate on a mandrel for finishing. The ends of the hub should be faced and the ring (A), Fig. 5, faced and turned. The bushings should be made of hard brass or phosphor bronze, preferably the latter. Bore out the center first and then mount the bushing on a mandrel and turn the outside to shape. The bushing should fit tightly in the end plate. When the bushing is driven into place, tool oil grooves in it, if they are desired, and ream with a ⅜ inch reamer.

The grease cups for the bearing lubrication are dimensioned in Fig. 7. A piece of brass tube (A) is threaded internally on both ends to receive the caps (B) and (C). The piece (C) has a ⅛ inch hole drilled through it for a ⅛ inch wick which feeds the grease to the bearing. This is shown at (D). A piece of brass spring wire is coiled up and bound to the wick near one end to force the wick against the shaft.

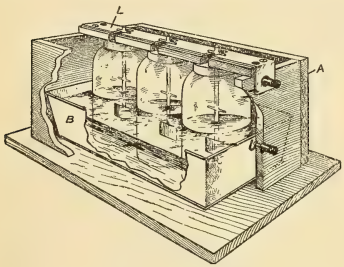
The grease cup is mounted on the under side of the bearing in a hole (H), Fig. 5, which is drilled and tapped to receive it. Only a ⅛ inch hole need be drilled through the bushing.

To insure alignment of the four holes through which bolts pass for securing the end plates on the field magnet, put the end plates in place and strap down on the drill press. Drill through the end plate into the field magnet with a 3/16 inch drill, and continue with a No. 29 drill. Then tap with a 3/16 inch 24 thread tap.

Bore the center hole in the brush holder, and drill the holes (B) for the brush studs.

A Liquid Condenser

In the condenser described below, instead of using tinfoil for coating the dielectric, a conducting liquid covered with ½ inch of boiled linseed oil is employed, a practice which obviates all brush discharge. It also has the additional advantage of insuring perfect contact between dielectric and coating, thus obviating all uneven distribution of strain and decreasing the liability of a breakdown.



LIQUID CONDENSER

A box (A) of proper dimensions is constructed of paraffined oak. The strip top (L) should have deep notches sawed in it to correspond with the mouths of the jars. A bread pan (B), long enough to hold three jars side by side, is placed in the box and in it three Mason pint jars.

The conducting liquid is then poured to within ¾ inch of the upper edge of bread pan and over it is placed ½ inch of boiled linseed oil. The jars are filled in the same manner. The conducting liquid may be either dilute sulphuric acid (fifteen parts water and one part acid), a strong solution of sal ammoniac, or a salt water solution.

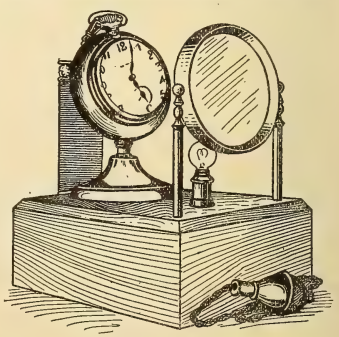
Three connectors are constructed by soldering a short length of No. 8 copper wire to a copper plate. Two supports of No. 12 copper wire are soldered at right angles to the large wire and are so spaced that when the upper one rests on the connecting strip the plate is immersed in the conducting liquid, and when the lower one rests on the connecting strip the plate clears the liquid by ½ inch or more.

The top is then put in place and over it the connecting strip. The three connectors are then slipped in place and the top and connecting strip are screwed to the box. A binding post is mounted on the bent end of the connecting strip. Another binding post is mounted on the same end of the box and fastened to it is a No. 12 wire which makes contact with the bread pan.

The capacity of one of these units of three jars is .00234 microfarads when all the jars are connected, .00156 when two are connected, and .00078 microfarads when one jar is connected, for it is a well known principle that when a number of condensers are connected in parallel the total capacity is equal to the sum of the individual capacities of the several condensers.

Watch Face Lighter and Magnifier

A useful little device for the bedroom during the winter months is a watch stand like the one illustrated. This stand

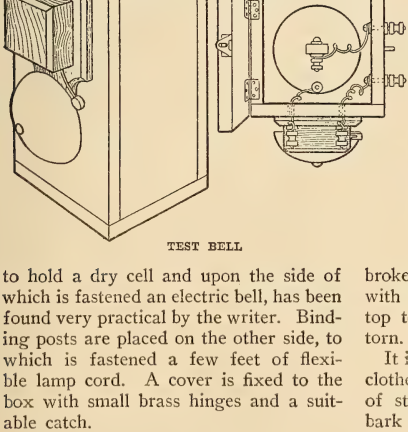

WATCH FACE LIGHTER

is manufactured large enough to contain a battery in the base to which is connected the lamp, cord and an ordinary push button.

After the watch is placed in the holder the lens may be set so that at any time during the night a push of the button will illuminate the watch face and the magnified hands and figures may be seen and the time ascertained without getting out of bed.

A Test Bell

A great many electricians are content with an electric bell bound to a dry cell with tape as a testing apparatus. Such an instrument may serve its purpose well for a while, but it really pays to have something better. A portable outfit consisting of a wooden box just large enough



TEST BELL

to hold a dry cell and upon the side of which is fastened an electric bell, has been found very practical by the writer. Binding posts are placed on the other side, to which is fastened a few feet of flexible lamp cord. A cover is fixed to the box with small brass hinges and a suitable catch.

No definite size can be given for the construction of the box as dry cells vary in size. The sketches will make the other details clear and explain the wiring of the apparatus.—H. Carl Cramer.

Curious Features of Lightning

One scientist had the unusual fortune to see a bolt of lightning strike an isolated cottonwood tree about a quarter of a mile away. The flash appeared as a superb column or shaft of light about 400 or 500 feet high, and eight to twelve inches in diameter, perfectly straight, vertical and steady. The shaft was white, but its base was tinged with red. This column seemed to stand between two diverging trunks of the tree and lasted about two seconds. Afterward the observer found that one of the two trunks of the double tree had its bark stripped off in the shape of a ribbon six inches wide and two yards long. The other trunk showed two furrows beginning ten feet above the ground. They looked as if they had been plowed by a piece of steel. There was no sign of fire.

Perhaps the most curious accompaniment of a lightning shock is the stripping off of the clothes of the person struck. This appears to be very common. There has been reported a case in which a man was struck by lightning while standing by a willow tree. Immediately afterward his shoes were found at the foot of the tree and the man was lying on his back two yards off absolutely naked except for part of the left arm of his flannel vest.

He was conscious, but much burned, and his left leg was broken. The field around was strewn with fragments of the clothes, torn from top to bottom. The shoes were partly torn.

It is supposed that the stripping of the clothes is caused by the rapid formation of steam. When trees are struck the bark is frequently torn off, probably by the electricity passing between it and the wood. It is not unreasonable to imagine that the same explanation applies to the removal of clothes.

Almost as remarkable is the shaving

effect that is sometimes seen. Two men in a windmill were struck by lightning. Both were rendered deaf, and the hair, beard and eyebrows of one were burned. A woman who was struck had the hair of her head completely removed. Sometimes the hair returns, and sometimes the part is rendered permanently bald.

When an electric current is passed through a number of persons holding hands it is generally felt most by those at the end of the chain. Several cases have been recorded in which only those which may be called the terminals of a series of animals are damaged. Five horses in a line received a stroke of lightning; only the first and the last were killed. On another occasion five horses in a stable were struck; the only animal to escape death was the horse in the center.

Several remarkable accounts have been recorded wherein alternate animals of a series have been killed. During a storm in 1901 lightning entered a stable where there were 20 cows and it killed ten of them. The first, the third, and so on, were killed, while the second, the fourth, and so on, survived. Men of science are at a loss to account for such cases as these.

Many cases of complete incineration are recorded. More remarkable are the instances in which the body of a man killed by lightning has appeared to be unaltered, but when touched has crumbled to dust. It is said that three soldiers took shelter under a tree, were killed by lightning, but remained standing. Even their clothes appeared to be intact; but when touched the bodies fell into a heap of ashes.

The lower animals appear to be more liable to be struck than human beings. A whole herd of cattle or sheep may be destroyed by lightning.

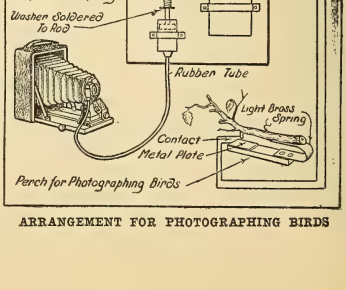
Representatives of surrounding objects are sometimes said to have been imprinted on the victims' skins by a lightning discharge. Nearly always the picture is that of a tree, and may be merely a branching mark made by the electricity.

Fireballs of globular lightning are the most mysterious of all the freakish manifestations thereof. For a long time men of science even doubted that there were such manifestations, but it seems that their reality has been demonstrated beyond all question. Ball or meteoric lightning is sometimes seen proceeding from cloud to cloud, sometimes rolling, bouncing and skipping along the ground. In 1885, in Constantinople, a globe of fire about the size of an orange is declared to have come spinning along, to have proceeded through an open window, and to have played about a gas jet.

Photographing Birds

In taking snap shot photographs of animals and birds, it is especially desirable to operate the camera shutter from a distance. By means of the arrangement shown in the illustration a bird alighting on the little perch brings the contact point down against the metal plate, completing the electrical circuit and actuating the shutter. The perch, of course, is connected in the electrical circuit, and the camera is focused with the shutter set.

The device consists of a piston forced into a cylinder by means of a spring. A strong electro-magnet, consisting of a

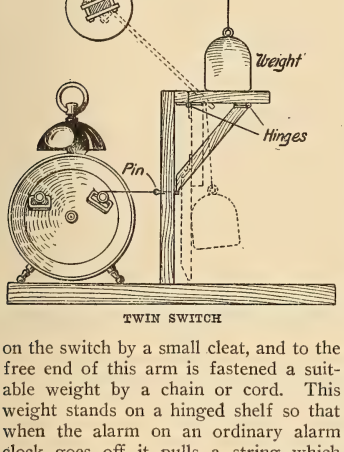


ARRANGEMENT FOR PHOTOGRAPHING BIRDS

couple of hundred turns of No. 20 wire, pulls over the lever, releasing the piston, which in descending, compresses the air in the cylinder, communicating with the camera shutter by a piece of rubber tubing.—W. G. Paulson.

Clock Operated Time Switch

The snap switch being already connected to the circuit and fastened on the wall, an arm of wood about eight inches long is fastened at one end to the button



TWIN SWITCH

on the switch by a small cleat, and to the free end of this arm is fastened a suitable weight by a chain or cord. This weight stands on a hinged shelf so that when the alarm on an ordinary alarm clock goes off it pulls a string which operates a small brass pin, which in turn releases the shelf, allowing the weight to drop to a fixed platform below. This is shown by the illustration. The alarm clock has its alarm wind key soldered so that the hinged portion stands out rigidly. Over this key is fastened a small wooden spool, slotted to fit over it. The release string is wound a couple of turns around this spool so that when the alarm goes off the key turns and the spool winds up pulling the brass release pin out. Needless to say the clock should set so that it will not pull over. Also the "set" position of the snap switch shall be such that a downward pull on the lever arm will snap the switch.—Henri Piccard.

An Industrial University

An original idea in the line of industrial training is to be promoted at Lomax, Ill., if present plans materialize. It is proposed to establish there an industrial university with a view to furnish not only the manufacturing interests at Lomax, but to small industries generally a highly trained class of employees, including electricians, mechanics, chemists and advertising and business managers. The large manufacturing companies, even, which can afford to maintain training and apprenticeship courses, find difficulty in securing enough such men and the smaller industrial concerns are at a still greater disadvantage.

In addition to this higher training for craftsmen and industrial business men, the Lomax Town Company proposes to institute an inventor's department; to give to any inventor free of charge, if he so desires, such advice as will enable him to make such experiments as will demonstrate the value of the idea, together with an opportunity to work out such idea and the use free of charge of exclusive and private apartments, equipped with all facilities for the development of such invention.

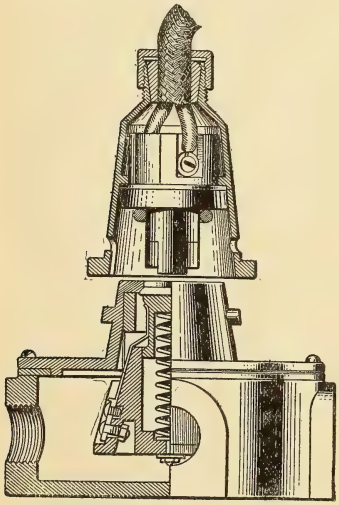
With the development of the invention to a point which will demonstrate its value, and, if such value is considered sufficient to justify its manufacture, such assistance will be given to the inventor as will enable him to secure binding patents, under the direction of the legal department of the university.

If the inventor is in a position financially to go into the manufacturing of his invention, a small or large unit of space in the "nursery" building would be placed at his disposal at a very small rental. In the event of the inability of the inventor to undertake the manufacture of his invention through lack of

necessary capital, the board of experts would make such recommendation and report on the probable value of the invention and give such assistance as would enable the inventor to secure such financial backing as might be necessary to carry on its manufacture under the most favorable conditions.

Water-Tight Receptacle and Plug

A receptacle that will last when installed in a damp place and permit an extension cord to be plugged upon it is a rare electrical fitting, as most electricians are aware.



WATER-TIGHT RECEPTACLE AND PLUG

The Conlan receptacle is built to meet this need. The cable terminals are in the upper water-tight part of the plug. Crowding the plug into the receptacle and giving it a turn holds it in place by side pins. When the plug is removed a valve and gasket, forced outward by a spring, operate to fill the hole and keep out water.

Double Jet Gasoline Torch

On a windy day in winter brazing telephone or telegraph wires is not an easy task, though one that has to be done. This work, however, is more easily accomplished with a double jet gasoline torch, for two hot jets are better than one in cold weather. To further aid in the application of a large amount of heat to a restricted area, this torch is equipped with a wind-shield, which adds to its efficiency on a windy day.

DOUBLE JET TORCH IN USE

Making Glass Threads

The delicate needles of fine galvanometers and other extremely sensitive laboratory instruments used to be suspended by threads of silk or by spider webbing. But both of these materials absorb moisture and therefore move with changes in the humidity of the room in which they are used. Indeed, the breath of a person working close to the instrument may moisten the air sufficiently to spoil the adjustment. A thread of glass, i. e., a glass tube drawn down to a very small diameter, will not do this, but the puzzle has been to make the same fine enough to have the required flexibility.

Recently Mr. H. S. Souttar, of London, has succeeded by employing a little electric furnace which enables him to draw glass tubes fairly uniform in size and having an outside diameter of about 1/25,000 inch, the bore of the tubes being approximately four-fifths of this diameter. To produce such exceedingly fine glass threads, Mr. Souttar starts with a small glass tube placed within a spiral of platinum wire in a mica box. When current is sent through the wire, this will become red hot, but the heat will only soften the lower end of the glass tube, as a brass tube shields all but the lower tip of the glass.

Before turning on the current, a metal rod is welded to the lower end of the glass and this rod projects through the bottom of the mica oven into a tube filled with a mixture of water and glycerin. When the heat softens the glass, the weight of this metal rod draws the glass into a tube scarcely visible to the naked eye, but so strong that the 1/25,000 inch tube will support a weight of five grams (about one-sixth ounce).

If the nature of the apparatus for which the delicate thread is to be used requires the suspension to be a conductor, the fine tube can either be filled with mercury or plated with a thin film of silver.

Electric Osmose in the Drying of Peat

The technical application of the principle of electric osmose or, as it is frequently and erroneously termed, "electric endosmosis," is exceedingly promising. To define we will use an illustration. In Fig. 1 the electric current is passing through a water solution of lithium sulphate though similar compounds would serve as well. Like all acids, bases and salts each molecule of this salt breaks up in water solution into two kinds of oppositely charged particles called ions—too small to be visible individually.

In fact, electricity is carried through solutions only when some ions are present, for they carry the current. In the illustration the positively charged lithium ions are attracted to the negative pole and reaching it, are discharged. Had copper sulphate been used copper plating would

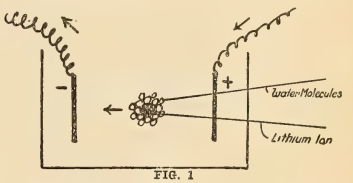


FIG. 1

have resulted. It seems well established by recent research work that all ions are hydrated—that is, have loosely attached to them some molecules of water which they carry along.

Lithium ions carry more water than any other known ion, sodium nearly as

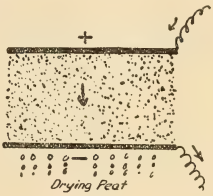


FIG. 2

much, potassium much less and hydrogen almost none. The sulphate ion carries very little. Naturally as the lithium ions proceed to the negative pole—by attraction—they carry a very appreciable quantity of water, while the negative sulphate ions, attracted in the opposite direction by the positive pole, carry very little water.

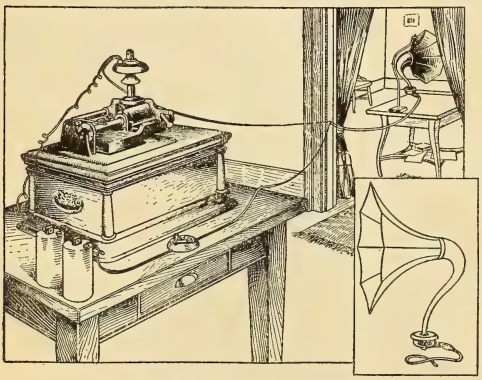
It is interesting to note that the heavily hydrated lithium ions are the slowest known and the least hydrated ions, hydrogen (derived from all acids) are the swiftest. Probably the dragging effect of the water molecules hanging on to the ions accounts for the difference in velocity.

The commercial application is easily shown by Fig. 2, which illustrates a new method of drying peat. The mass of wet peat is pressed between two metallic plates which serve as electrodes, the lower plate being perforated. Of course, the peat water contains some dissolved salts and consequently some positive ions. As these move down to the lower negative plate under a pressure of 100 volts or more they carry with them their little crowd of clinging water molecules. When the ions are discharged on this negative electrode the water lets go and drains off through the perforations in the plate. In Germany peat is dried as cheaply by this means as by the oven process. The enormous use of peat as a fuel makes the process important.—HARRY N. HOLMES.

Transmitting Phonograph Music

The illustration shows the arrangement I have used at home to entertain friends, and at the same time it enables me to have the phonograph in a room away from the crowd.

Procure a long distance transmitter, including the mouthpiece, and set this on the reproducer stem. Fasten a watch-case receiver to a phonograph horn in the room where the music is to be delivered. Connect as shown, using dry cells, and a two point switch to control the current. A small choke coil placed in the circuit will sometimes improve the sound at the horn.—E. H. WINKLER.



DISTANT PHONOGRAPH TRANSMITTER

Care of Commutator and Brushes

The commutator of a direct current machine being built up of comparatively small bars or segments of copper which are insulated from each other by strips of mica is sometimes troublesome and hard to make run smoothly. Some of the common troubles are here noted, with remedies.

High mica is occasioned by the copper segments wearing away faster, due to frictional contact with the brushes, than the mica, thus causing the brushes to jump, resulting in a blackened commutator surface, caused by the consequent arcing. The remedy is to undercut the mica, or groove it out between the bars to about 1/16 inch in depth and about 1/32 inch in width. This may be done with one of the many devices on the market, or with a hacksaw blade, by replacing the frame with a "stiffener" fitted to the blade. When the mica has been removed, all the slots should be carefully cleaned out and kept clean. After the whole surface has been thoroughly sandpapered, the machine may be placed in operation.

Sparking caused by dirty brush holders preventing the brushes from following any slightly irregular parts on the surface of the commutator may be remedied by using a piece of fine grained grindstone, shaped to the commutator surface and held in contact therewith

by hand, with the machine slowly revolving until the surface assumes a clean appearance. It may then be finished, using finer grades of sandpaper, and a high polish may be given by using ordinary lubricating oil in combination with the paper.

In case of dirty and gummed brush holders, they should be thoroughly wiped or scraped if necessary by using kerosene as a remover of the gummy accumulation. When this is done, the brushes, if of the proper size, should then be free to hug the surface.

Chattering and squeaking brushes, being usually more annoying to the attendant than harmful to the machine, may be remedied by readjusting the brushes' angular contact with the commutator. One way to relieve the squeaking is to remove one brush out of each arm, in a spiral path around the whole commutator, and boil in a heavy engine of cylinder oil. Allow them to drain before being replaced. Thus the whole width of the commutator will be lubricated. A little kerosene sparingly applied with a piece of heavy canvas may be used while the machine is running, to remove any gummed oils, etc. Following this by a slight application of engine oil will, as a rule, give good results.—H. G. Wilson.

New Use for Conduit

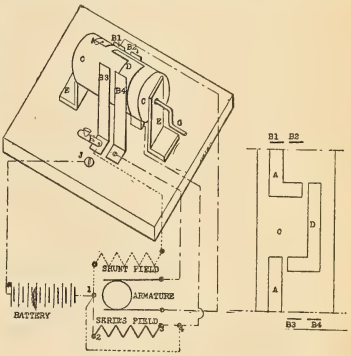
A novel use for clay conduit is reported in the *Western Electric News*.

A wealthy wool merchant, who is a lover of good living, has decided to build a wine cellar in his house. He has bought 600 twelve-inch lengths of vitrified clay conduit and will build the tile ducts into the walls, using them as receptacles for wine bottles. Each piece of conduit, being about a foot long and four inches in diameter, is just the right size to hold a quart bottle comfortably.

This illustrates very clearly the fact that more than one kind of "juice" can be run through a conduit. This may also serve as a hint to architects.

Reversing Switch for Small Motor

An easily made and simple contrivance for reversing a small motor is shown in the sketch. The cylinder (C) can be made from a cork or an old spool with the hole through its center plugged and a piece of No. 14 iron wire (G) wedged in firmly and bent, as shown, to form an axle and handle. The supports (E) may be made from light strip brass or iron



REVERSING SWITCH FOR SMALL MOTOR

or, lacking anything better, a small wooden box with holes in its opposite sides may be used for the supporting framework.

The brushes (B1, B2, B3, B4)—pieces of an old alarm clock spring, or light strips of spring brass or tin—should be bent as shown and fastened with screws so they will bear against (C); (B2) and (B3) must be directly opposite each other and half way from each end of (C); (B1) must be to the left of (B2) and on the same side of (C); (B4) must be to the right of (B3). The two strips (A) and (D) are made of thin sheet copper and are exactly the same size and shape. The surface of (C) rolled out flat shows the position in which these strips must be fastened on it.

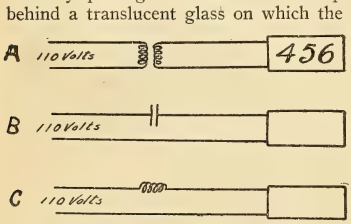
Two hook-ups are shown, the series field being the best adapted to most small

battery motors. To connect the motor if series wound, use the dash dot wires and the solid heavy "series field." Pay no attention to the dotted wires or to the dotted "shunt field." With this connection the switch (HJ) may be eliminated as whenever the reverser is turned into a position that stops the motor the battery circuit must of necessity be open. Connect wire (J) to (B3).

To connect the motor shunt wound, disregard the solid heavy "series field" and wire (1, 2, 3, 4) using the dotted "shunt field" and the dotted wires. Use all the dash dot wires also, except wire (1, 2, 3, 4). Switch (HJ) must be used with this hook up, as otherwise there would always be a battery circuit closed through the field.—H. S. Worrell.

Illuminated House Numbers

When one is required to find a strange address after dark, he is impressed with the desirability of illuminated house numbers. This, of course, can easily be done by placing an incandescent lamp behind a translucent glass on which the



THREE WAYS OF CONNECTING ILLUMINATED HOUSE NUMBERS

number has been painted. The smallest 110 volt incandescent lamp available is of higher candlepower than necessary for this purpose, so that it is desirable to adopt other means. Here are given three methods of obtaining the desired result. These methods are applicable to any case where it is desired to burn low voltage lamps on a commercial alternating current lighting circuit.

Obviously it is possible to use a transformer as shown in (A). This might be built after some of the methods outlined in this magazine in previous numbers.

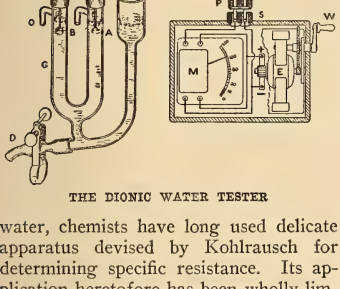
The scheme shown at (B) utilizes telephone condensers and their property of allowing an alternating current to flow through them. The smaller the current required by the lamp, the less capacity is necessary in the condenser. With a small lamp taking 0.25 amperes the capacity required is from two to four microfarads, if the frequency of the alternating current is 60 cycles per second, as is usually the case. In this case there is no loss in the condenser, as would be experienced if a resistance was employed to reduce the voltage at the lamp.

The scheme shown at (C) employs an inductance which consists of a coil of wire wound upon an iron core consisting of a bundle of iron wires. Make an iron core by winding soft iron wire on a wooden cylinder about four inches in diameter. The core should be of one square inch cross-section or over and the wires should be well bound. Wind No. 18 double cotton covered wire on this ring, adding shellac to each layer. Do not have the winding too thick in order that the coil may not overheat. The number of turns required depends upon the amperage of the lamp to be used. About 800 turns on an iron core is sufficient to place in series with a ten volt, ten candlepower tungsten sign lamp on a 115 volt alternating current circuit. One thousand turns is sufficient for a four volt, four candlepower lamp. A continuous iron core is desirable, although a cylindrical coil with a bundle of wires in the middle can be used, but more turns must be provided. This latter method has an advantage of adjusting the position of the core and size of it to fit the lamp used.

The advantage of these methods in reducing the lamp voltage and permitting the use of miniature lamps on commercial circuits is that they entail very little loss of energy in the apparatus. This would not be true, of course, if resistance was used for the same purpose.

Electric Testing of Water Supply

Pure water is practically a nonconductor of electricity, while water containing in solution such substances as acids, bases and salts conducts the current very well. To measure the conductivity—the reciprocal of the specific resistance—of



THE DIONIC WATER TESTER

water, chemists have long used delicate apparatus devised by Kohlrausch for determining specific resistance. Its application heretofore has been wholly limited to water of a high degree of purity and the conductivity was considered directly proportional to the amount of impurity.

Recently a simple device called the Dionic water tester has been put on the market in England and America to use the above principle for measuring approximately and quickly the hardness of water, sewage contamination in rivers, minute traces of impurity in distilled water, priming of steam boilers, etc.

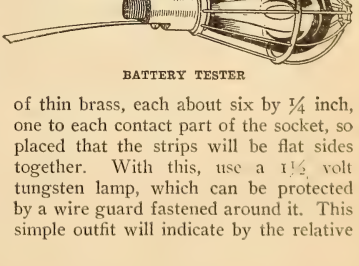
This simple and portable apparatus consists of a U tube of glass containing two platinum electrodes and in addition a hand dynamo and a direct reading conductivity meter. The U tube is washed out and filled with the water to be tested. By the use of a constant speed clutch current at a pressure of 100 volts is maintained and, passing through the water column and the meter, gives a direct reading on the scale of the resistance of the water. In making this scale due allowance was made for all disturbing factors. To be exact this scale is written to read in conductivity—the reciprocal of resistance.

The next step is to have a chemical analysis of the water made and compared with the conductivity reading of the Dionic water tester. From day to day new conductivity readings may be taken in two minutes by unskilled workmen. If these readings are practically the same it is reasonable to suppose there is little or no change in the chemical content of the water. In proportion to any variation in the conductivity one infers a corresponding variation in the chemical content. Thus the expense of more than one chemical analysis is done away with and frequent control tests are made with ease.

Of course conductivity measurements do not discriminate between one kind of impurity and another—analysis alone can do that; but in most instances of water testing for engineering purposes the nature of the impurities present is known, having been learned once for all by a chemist. Further tests then are needed only to show increase or decrease in the percentage of impurity and the new electric device performs these tests with a simplicity and speed impossible in chemistry.

A Convenient Battery Tester

The battery tester here described is excellent in ignition, signaling, bell and battery work. Take an ordinary candelabra or metal socket and solder two strips



BATTERY TESTER

of thin brass, each about six by ¼ inch, one to each contact part of the socket, so placed that the strips will be flat sides together. With this, use a 1½ volt tungsten lamp, which can be protected by a wire guard fastened around it. This simple outfit will indicate by the relative

brightness of the lamp when applied to a battery, just what condition the battery is in. In testing, the strips are held apart with the finger sufficiently to touch the binding posts or other contacts.—Henri Piccard.

Testing the Permanence of Colors

It is well known that besides the visible rays in sunlight, the invisible chemical rays, the ultra-violet rays, tend to produce chemical effects, apparently because they lead to resonance of the electrons within the atom. It is these rays which cause snow blindness, sunburn and even, it is thought, the marking of small pox. They are also largely responsible for the deterioration in color of dyed materials. In a recent number of *Science Progress* Mr. J. S. Dow mentions this fact, and alludes to the new quartz tube mercury vapour lamp, which is very strong in these rays. So well is this effect recognized that the carpet manufacturers of North Germany are said to use the new quartz lamp as a means of testing the permanence of their dyes. Formerly they used to send the goods to the sunny south, where there was abundant bright daylight, to which the materials were exposed for weeks at a time. But now it is possible to do by artificial light in a few days what it formerly took weeks to accomplish. And there is also the advantage that this can be done irrespective of climatic conditions.

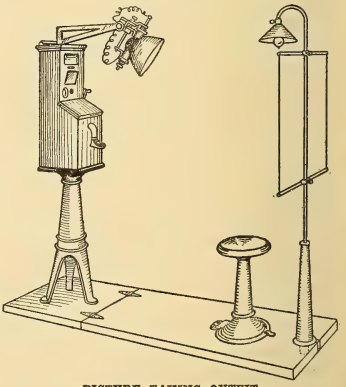
Powerful Incandescent Lamps

An incandescent lamp giving as much light as an arc lamp would be preferable to the arc lamp on account of the superior quality of its light, and its slighter demand for supervision. But for a long time it was found impossible to give to an incandescent lamp a power exceeding about 250 candles, because of the extreme fragility of the filaments required for high intensities of light. This difficulty has been, at least to a large degree, overcome in the Fixfar incandescent lamp, manufactured in Paris. High tension current is avoided by means of a special transformer of the Weissman type, which is placed in the lamp itself, and lowers the tension of an alternating current to 40 volts. The filaments are larger than in the ordinary high tension lamp, and the temperature higher, so that a luminosity of from 100 to 1,200 candles may be obtained.

Take Your Own Picture

Telling yourself to "look pleasant, please," while you take your own picture is the end in view by John Herricht, New York City, who has a patent upon an automatic photographing machine.

The apparatus consists of an arc lamp, a cabinet containing mechanism for actu-



PICTURE TAKING OUTFIT

ating the arc, and also for holding photographic material. A stool, a screen for a background, and an incandescent lamp complete the equipment, which is mounted on a common base. The incandescent lamp is used so that no strong shadows may be present. Pulling a lever on the cabinet imparts enough power to the mechanism to bring the lamp carbons together for a sufficient time to take your picture when seated on the stool.

Should Inventing Be Taught?

By ALBERT SCHEIBLE, M.E.

If there is any one term that has become more prominent than any other during the industrial and commercial developments of the last few years, it is the word "efficiency." Old as the term is, we had been in the habit of applying it almost wholly to machinery or mechanical and electrical equipment. Then it suddenly dawned upon some that if a motor driven shovel is to be judged by its effectiveness, the same standard should hold also for men wielding shovels. And if variations in the design of operative parts and in their rate of motion can make a great difference in the output of a power driven mechanism, might not the same sort of carefully studied changes work a corresponding improvement in the human machine when employed at a given operation?

Thus a consideration of human efficiency took its place with the study of machine efficiencies and the past decade has marked decided improvements all along the line.

All around us there is now a concerted striving for higher efficiency, often extending even into the work of churches and other religious organizations. Yet in the midst of it all there is one line of human endeavor in which the average efficiency is admitted to be very low and in which no determined effort has been made toward improvement. It is the field of independent inventing. Where investigations and experiments leading to inventions are conducted in manufacturing establishments of any size, these are generally carefully planned and highly effective in their results. Particularly is this true of some of the large electrical manufacturing concerns which owe their continued prominence partly to crews of highly trained men paid both for their experimental and for their inventive ability.

But when we leave these inventive groups and look about us among the scattered inventors of the country, we immediately strike almost the opposite extreme. Instead of men expert at the particular lines in which they are working either in the laboratory or on the drafting board, we find men, women and boys dabbling in lines of which they know very little. Instead of men consulting with others who have had valuable experience, we find suspicious and secretive natures which ask no counsel and profit by none. In place of a careful analysis of the commercial outlook for a new device, to determine whether or not the prospects would warrant the cost of patenting it, we find a rash assumption that whatever is novel must be of commercial value. Instead of a basic understanding of our patent system as a protection for new articles having sufficient merit to make them profitably salable, we find the curious conception that the patenting in itself will give a value to a new idea.

Thus in a dozen different ways the point of view of the corporation hired designer is radically different from that of the average isolated inventor. The latter may be just as ingenious, as persistent and as versatile as the former, but what does it avail him? Perhaps he could ably defend his own point of view. But of this you may be sure: the experienced business man knows both the laws and the trade customs, and when he pays good salaries to men of ingenuity he sees to it that they work in harmony with our existing patent system and with commercial practice. Right here is where the isolated inventor usually falls down and that is why the average patentee gets no returns from his invention. He assumes that he knows our patent system from having read some advertising liter-

ature, assuming also that he is qualified to enter the ranks of successful patentees and that his own knowledge and judgment are ample.

And why not? Does not Uncle Sam say that a patent may be obtained by "any person who has invented or discovered?" What the inventor overlooks is the fact that our patent system was chiefly designed to protect those who would not only evolve the new idea but who also would introduce it upon the market. To do the latter means a business acumen, a knowledge of market conditions, an ability to develop a crude idea into a commercial article and a keen understanding of the elements of novelty in a new device—all of which are rarely found in the isolated inventor. Moreover, if his patent is really to protect him, he should know how to judge the strength or weakness of a patent, for shoddy in patents wears even less well than in clothes. He must know how to predetermine the extent to which he can monopolize a certain field, for all that the patent does is to give him a basis for a certain seventeen year monopoly. He must know how to tell whether or not the money spent for the patenting should be classed as a promising investment or as a rash speculation. All of this—and more too—is presupposed in the applicant to whom a United States patent really offers returns for his time and money.

But what if the man of ingenuity does not have all of these qualifications and is not connected with a concern that will supply the deficiencies for him? Is he merely to blunder along and take the long chances, with the odds tremendously in favor of those who are otherwise situated? Not when he wakes up, though it is exactly what so many thousands have done in the past. To believe that he will continue doing so when he once understands their situation, would be to malign the prudence of the American inventor.

No, what the inventor of tomorrow will do is to post himself on the implied requirements for a successful patentee and then try to measure up to them. If he has been handicapped by scattering his efforts over a large variety of lines, he will learn to concentrate on some one or two that look promising and in which he can thoroughly ground himself. If his conceptions of inventions and patents are vague and somewhat erroneous (as they are in the case of most inventors) he will be meek enough to admit it, shrewd enough to seek and pay for competent advice, and persistent enough to buckle down to instruction in this line just as he would in any other subject worthy of his time and energy.

"But," you may ask, "can inventing be taught?" Yes, and no. If a man has no ingenuity, no one can funnel it into him. The inventive instinct must be present—the ability to see things not only in their ordinary relations but in uncommon ones also. If this germ of ingenuity is present, why should it not be trained like any other faculty? To do so will require patience and persistence, but without these how can one expect to excel in any line? Of couse, much of this training, as also of the related advice and guidance regarding the commercializing of inventions and the really protective patenting of them, must come from men of experience, men who have actually been "through the mill" as successful inventors and patentees. Perhaps that fact has been most largely responsible for delaying such instruction heretofore, as successful inventors are usually absorbed in their own lines and often jealous of the progress of others. Besides, not every one has that ability to teach and guide others which must also be a prime requisite in the successful instructor of inventors.

But there are such, and when the demand for them arises, when the thousands of patentees who do not even know why their patents have brought no returns realize that they have rushed rashly into a field in which proper training is a requisite for success; when men in all lines learn that remunerative inventing cannot be learnt over night, but is a subject requiring careful study under competent

guidance, and when the holding of a patent comes to mean an honor only when the same brings returns for the patentee —then inventing will be recognized as a legitimate and much needed topic of either oral or correspondence instruction. And who will pay for such instruction? Apparently the inventor will bear the burden, but in reality much of it will fall upon the government and the patent attorneys, for the immediate result will be a great reduction in numbers of the kind of patent applications which now are so unproductive of returns. Indeed, a small part of what the average patentee now spends for procuring a single unremunerative patent ought to pay for sufficient guidance to give him a real opportunity when he again approaches the patent office with an application. But first of all, he must admit that he still has much to learn—and when will the average American inventor be ready to make that admission?

Turning Point in Pupin's Life

Michael I. Pupin, to whom we owe the Pupin loading coil, which, installed at intervals in a telephone circuit has added so much to the possibilities of long distance telephony, was turned from his study of Latin and Greek at Columbia University to physics by witnessing Joseph Henry's experiment showing the presence and effect of electro-magnetic induction. Before the American Institute of Electrical Engineers recently he told of the incident.

"It is thirty years to a day since I first saw Henry's discovery. I was a student at Columbia at that time, very fond of Greek and Latin, in fact, so fond of it that I devoted most of my time to the study of Greek and Latin and classical literature. At the same time I was fond of mathematics and of physics, and of chemistry, and there was a doubt in my mind whether, when I graduated, I should take up as my life work classical studies or physics. One day I saw an experiment in the lecture room performed by the late Professor Rood, of Columbia. He had a coil of wire, the terminals of which were connected to a galvanoscope, which was attached to the side of the wall so that the class could see the movement of the magnetic needle. The coil was in his left hand, and he had a magnet in his right hand. He moved the magnet a little bit, and off went the needle to one side, and then he moved the coil back, and the needle moved in the opposite direction. They say that the magnetic needle moves because it is acted upon by the passage of electricity through the coil. Be that as it may, that needle, I am sure, was never as much thrilled as I was thrilled with that experiment, and I said, 'Good-by, Latin; good-by, Greek; I am going to study physics.'"

Making Sugar by Electricity

Whether the time will ever come when it will be possible to manufacture sugar on a commercial scale by the action of a silent electric discharge upon carbon dioxide and water may be doubted, but at any rate sugar has been formed in that way, and, it is understood, patents have been taken out for the synthetic production of sugar by this method. The transformations thus effected appear to be brought about under conditions approximating those that exist in plants.

Ice Insulated Conduits

As electricians know, ice is an almost perfect non-conductor of electricity. It has been suggested that there be used for an electric conductor a pipe of metal. It is to be immersed in a subway kept filled with water and through the pipe cold brine from a freezing machine is to circulate. This would freeze the water in contact with the pipe, thereby insulating it. The brine could be used in supplying artificial cold to refrigerators in stores, markets, or even in private houses. The simplicity of the project and the complete dispensing with ordinary insulation are very striking.

Electrical Securities

By "CONTANGO"

The Prosperity of the Country in the Rural Districts as It Relates to Electrical Development —The Great Extension of Electric Lighting, Power and Telephone Systems the Past Year—How the Farmer Now Possessing an Automobile Insists on Having Electric Light and Every Other Electrical Convenience—The Result as It Affects the Digestion of Electrical Securities—A Growing Investment Opportunity Is the Outlook for the Present and for the Immediate Future.

It has been said that this is the electrical age at high tension. The phenomenal expansion in all branches of electrical science during the last few years has surprised even those most enthusiastically interested in electricity. It is a fact that the public has come at last to realize, if slowly, that the age of steam has passed, and since the beginning of this year stocks of electrical manufacturing companies, hydro-electric, electric traction and all manner of electric light and power companies have been in constant demand. Indeed all such securities—using the term in its widest sense—have shown a generally rising tendency with many a big upward movement in particular favorites.

It will be quite in order then at this time, the close of the year, to examine a little closely as to the reasons for all this and indicate at the threshold of the new year something of what the future is likely to hold in store for those interested in the shares and bonds of electrical companies.

The great prominent fact that must always be kept in mind is the determination of the American people at large, not necessarily to live in extreme luxury, but to have every convenience they can —every practical convenience that may be obtained.

Edison, before the recent political campaign closed, on being asked as to his opinions, was quoted as saying that he considered one of the main causes of the higher cost of living and high prices generally would be found in the higher standard set and demanded by the American people, from year to year, as to what should constitute a decent and live existence.

The real gist of the matter lies in the fact that men of affairs, of positive genius in observing opportunities, have gone ahead to utilize this or that inventor's discovery or dream and make it practicable, and then bit by bit the public in general has been converted and convinced, and each unit jealous or combative, struggling or aggressive, has followed the natural course and trend of human nature that only really lives by being abreast of the flood. So now it comes about, as our Sunday paper comic supplements have oftentimes pointed out, the farmer in remotest places is not in the least content without his "machine," his "phone," and his "'lectric light," and the more light the better.

You have been told of the bumper crops of the United States and Canada this eventful year just closing. They mean of themselves additional railway construction, the carrying out of improved facilities for connection between point and point. They mean increased spending power all round and they mean that those who have been projecting power development, electric lines of traction, transmission lines for current and the like enterprises have merely discounted to a very small degree an era which, if not spoiled by mismanagement, wrongful exploitation or insincerity of purpose, will, as time goes on, only reach its climax when modern convenience is available to all and in every place.

You have been told over and over again that concentration, good manage-

ment and honest reputation are the safeguards and security of these electrical enterprises. You have been warned over and over again against wild-cat propositions, be it in local water power schemes or local trolley lines. You cannot go it alone, for the part is never greater than the whole and this entire scheme of things electrical is working itself down to the final point of economy and efficiency derived in the main from consolidation and centralization.

You in the country districts, in the smaller towns, dependent on these districts, have done, are doing, and will do more than any others to contribute to this spread in the use of modern conveniences. Then the best thing to do is to participate as far as possible in their practical development. This you can best achieve by placing your money as you may have it to spare, in the best public utility company stocks and securities—such for example as the Public Service Company of Northern Illinois, which exactly illustrates the points just brought out, serving as it does an enormous territory in the central and northern parts of Illinois with an ever growing and ever prospering population to support it. The success of such companies depends on your support, both ways, and of course on good management. The more you are interested the better the service.

As to the management, this does not only mean the mere operation of plants, lines or systems: it means management of finance whereby the capitalization and bonded indebtedness march together in reasonable relations; whereby the former is kept fairly down to actual physical assets and properties. You must remember in this connection that those who do things and project and carry out enterprises must have a reasonable interest for their ability. And as to bonded indebtedness: this must never attain the size of a stupendous load or unwieldly mortgage. Bonded indebtedness must go hand in hand absolutely with the physical development of the property and no further. These things have already been carefully explained to you in detail.

An expansion or boom in one section of the country, whether it be derived from exceptionally good crops, exceptionally heavy settling up by immigration or by some internal movement, or from railway construction, inevitably means corresponding activity in electrical progress. For the very simple reason that trade—commercial activity—always follows the electrical star—the electric light first and with it the trolley line, then the use of electric power and electric domestic conveniences and accommodations.

Having made these points, a few instances, only a very few, for many figures but confuse the mind and spoil the definite aim, will be given as to the success achieved by some electrical companies taken at random from different points, and related not at all except in the particular of good management, and, in some cases, as parts of a chain, in wisely governed and financed systems. For example it may be stated that work on the big hydro-electric plant of the Ozark Power & Water Company, on the White River at Branson, Mo., keeps 400 men busy on the completion of the concrete dam and power house, and it is expected that the dam will be ready to impound water by February 1, 1913, and that the entire plant will be in operation by April 1 next. There is every reason to believe that shareholders of this company will be well satisfied with its operations. The market for the power is at hand. The distance from the Ozark dam to the Springfield sub-station is just short of 50 miles, the transmission line from Joplin to Springfield having now been completed. This gives one an idea in regard to construction. Or, again, from results accomplished, take the American Gas & Electric Company, which was expected at the time this article was written to increase its divi-

dend rate from seven per cent to eight per cent. This company increased its dividend last June from six to seven per cent. All the subsidiary companies of the corporation have shown gains over 1911. Thus for the twelve months ended August 31 the Atlantic City Electric Company showed betterment of gross to the extent of ten per cent, an increase in net of 22 per cent. The Canton Electric Company, Muncie Electric Company, Rockford Electric Company and Scranton Electric Company have all shown as good an advance, the Muncie Electric Company even showing a betterment of 36 per cent in net earnings and an increase of exactly 50 per cent in the surplus after all charges.

Again a few words as to a recent bond issue of a company mentioned in this series. There is more behind the latest financing of the Pacific Gas & Electric Company, which not long since issued $5,000,000 new five per cent bonds, than appeared in the mere announcement of the offering. The Pacific Gas & Electric Company, through an old agreement with its competitor, the Western Power Company, buys something like 25,000 horsepower from the latter company every year. The proceeds of the new issue of bonds, however, are to be used to make various additions and improvements, including a new hydro-electric development which will have an initial capacity of 53,000 horsepower. This development will make the company independent of outside sources of power supply, otherwise the Western Power Company. Within a year the Pacific Gas & Electric Company will be enabled to go it alone, and thereafter there will be no contract relations whatever between the big company and its smaller rival. It is estimated that the savings thereby will be double the amount of the interest on the new bonds.

One may note, too, that there has been a decided boom in the Northwest for some time past and therefore the earnings of properties in the best known cities of Minnesota and Wisconsin must be feeling the favorable condition of affairs. Thus the Northern States Power Company, which company not long ago took over the Minneapolis General Electric Company, is doing well, with the result that the preferred and common stocks are again in better demand. Another company, the recently formed holding company known as the American Public Utilities Company, financed by the Kelsey-Brewer interests of Grand Rapids, Mich., has in the first months of its existence been making a most excellent showing. The management makes an estimate of the probable results for the year ended June 30, 1913, placing gross earnings at $1,134,583, with net earnings of $535,599, which after interest on the underlying securities shall have been taken care of and regular payment on the preferred shares made, means net earnings at the rate of 7.37 on the $2,150,000 common stock outstanding. Reports of operations of all the companies forming the holding company have shown good increases all this year.

In conclusion let it be said that in addition to the varied uses of electricity in the power field of agriculture, it is certain that the general introduction of electric lighting, both along roads and in dwellings, will do much to transform the countryside and diminish the danger from fire. When to this is added the possibilities of the employment of electric traction for passengers and farm products, it will be seen that the whole future prospect is one of national importance. It has been said that much of the idle land in the United States is unused because of the distance from railways, and that it does not require a very great distance from transportation to render a good piece of land unprofitable. When, however, a few miles of electric railway running alongside of a country road, may be made to act as a feeder to the trunk line of a steam railway, there will be opened up for productiveness and profit many thousands of acres of land at present unprofitable.

SCIENCE EXTRACTS FROM FOREIGN JOURNALS

Ozone Purifying System a Success in St. Petersburg.—The electric method of purifying the city water for St. Petersburg is meeting with so much success that the municipality intends to make a large increase in the present plant. The ozone system is used here, and it is very effective in destroying the disease germs which the water of the Neva contains in large numbers, so that a very good drinking water is the result. At present the city is planning to build a new purifying works at a cost of $5,000,000, so as to serve for the whole water supply of St. Petersburg, this being no less than 60,000,000 gallons per day. Among other large companies which have sent in proposals for the new plant is the English Ozonair firm, and as they made the best offer, it is thought that they will secure the contract. Their process is an interesting one, and consists in atomizing the water in the presence of a stream of ozone given by the electric discharge apparatus, and the minute particles of liquid are allowed to fall on a pile of glass spheres, through whose gaps is sent an uprush of ozone. In this way the water and ozone are well brought in contact, so that the purifying action can take place.—*The Electrician, London.*

Making a Motor Dust Proof.—A somewhat novel method of running an electric motor so as to make it dust proof is found in a cement works at Fyansford, in Australia, and the electric plant is specially designed so as to work in dusty air such as is caused by handling the cement. The motor is of the 500 volt, three phase type, and is all enclosed by a steel casing, but there is a good inrush of air through the revolving part by means of openings. An air fan is placed on the shaft of the motor and is also enclosed, and the piping connects with the casing of the electric motor and also with the outside air in such a way that the clean air is taken in from the outside of the building, goes through the motor and cools it, and is then expelled to the outside. In this way the air circulation has no connection with the dusty air within the building, so that the motor always works in clean and cool air and thus works under the best conditions.—*The Electrician, London.*

Electric Motors Dry Themselves.—In a German works which were using a number of electric motors to drive the machinery, it was found that the motors became so damp during the idle periods that it was unsafe to work them without first drying out the windings. An idea occurred to one of the engineers to send a current through the wires of the motors while they were not running, so as to heat them up and thus give them an electric drying by a slow and safe heat. Accordingly he connected the motors to the low tension side of a transformer so as to obtain 260 volts, and after leaving this current on the motors for a time, it was found that they were very well dried out. The current was not strong enough to run the motors, as it was quite below the standard current. As the air in the room was always very damp, it was decided to put this low tension current on the motors at all times when they were out of use, and although this is not very economical, it allows of keeping the motors always in good shape and ready to run, as no moisture can collect upon the inside.—*The Electrician, London.*

The Great Crane of Hamburg.—What is probably the largest electric crane in the world is being built at Hamburg by one of the well known German construction firms, and it is to be used in handling material in the shipbuilding docks. The crane can lift a weight of 275 tons, and is mounted as a pivoting crane, being turned about its center by an electric motor mechanism. It has a reach of nearly 250 feet for handling the load, so that it covers a circle of 500

feet diameter in which it can work. Loads can be raised from any point within this circle to a height of 300 feet. It is expected to have the crane completed before the end of the year, and it is to cost $200,000.—*Genie Civil, Paris.*

Wireless in the Antarctic.—Wireless telegraphy can sometimes be carried out in the Antarctic regions at much greater distances than are usually covered, owing to the state of the air which prevails there at times. A case of this kind is noticed in a wireless plant erected on Macquarie Island, in the Southern Ocean, and when using an ordinary ship's set, the station is able to pick up messages from Freemantle and then repeat them to Fiji, this being due to the favorable conditions which prevail there. Ships as a rule can only receive messages coming from 200 or 300 miles distance, but when in these regions in the long stretch of ocean and absence of bad atmospheric influences they are able to cover much greater distances. The present wireless post is also used as a repeating station to New Zealand.—*Australian Mining Standard.*

Desert Earth Conducts Wireless Waves.—According to the researches made by Dr. Löwy and Göttingen University, the rocks which make up the principal part of the earth's mass can be traversed by the electric waves such as are used in wireless telegraphy, but the bodies of water as well as water-soaked layers of the earth and metals or minerals which conduct the current will not give passage to the waves. As the earth is almost entirely covered by damp earth or bodies of water, the waves are not able to penetrate into the earth when they are sent out from a point on the surface, except when the wireless post is placed in a region which is quite dry—for instance, in the desert. Such posts can also detect underground bodies of water, seeing that the waves will not pass through, but are reflected. To prove his ideas, he took an apparatus into a mine which had over it 6,000 feet of dry rock, with a body of water above this. He found that the waves easily passed through the rock, but went no further, as the water cut them off and reflected them.—*Elektechmischer Anzeiger, Berlin.*

Curious Electrical Effects in the Lake Tchad Region.—Some curious electrical effects were observed in Africa, in the Lake Tchad region, by Dr. Gaillard, a medical officer of the French colonial troops, when on an expedition in the districts of the Niger and Tchad. On one occasion at about 5:30 p. m. he was leaving camp with a party, when he noticed that the horse which preceded him, and was led by a groom, gave rise to electric sparks when brushing the sides with his tail. In fact, the air of these regions seems to be favorable to electric spark effects, for he noticed quite strong sparks given off by his mosquito net. He was lying on a camp bed and stroked the bar with the fingers, and was thus able to draw off sparks which made quite a crackling sound and gave out some light as well. The longest sparks were given by rubbing with the head instead of the fingers, as it is known that the hair will give good electrical effects. Such action was better noticed inside of the straw or earth huts than in the open air.—*Cosmos, Paris.*

The St. Gotthard Electrification.—The commission which was appointed in Switzerland to examine the question of using electricity on the St. Gotthard Railroad has now made a favorable report. The main conclusions are that, allowing double the amount of traffic as shown for 1904, the cost of the enterprise would be $13,000,000, most of which is needed for the electric outfit proper. Against this, the cost of transportation would be lowered at the rate of 72 against 94. On the other hand, Dr. Kummel has been making some calculations on the subject, and shows that a hydraulic plant of 20,000 to 27,000 horsepower would be needed at the north side of the tunnel, working in connection with a similar station of 37,000 horsepower on the south side.

The two regions should be operated separately, however. Water power can be had which will easily cover this amount. —*Elektr. und Masch., Berlin.*

Suspended in Mid-Air.—A trip on an aerial cable line is greatly enjoyed by tourists, as it is quite a sensation to be suspended in a small car which hangs down from an overhead cable and runs high across the surrounding country, and in this way a far-reaching view is to be had. The first aerial line to be constructed in Austria runs from Lana up to the top of the elevated point of Vigiljoch, and it was opened up during the summer season. The length and height are about the same, or 3,500 feet, so that the cableway is a steep one. Cables are run over towers of 100 feet height, and from these a car is hung down from a rolling carriage. Drawing cables are attached to the carriage so as to propel it by means of electric motor driven drums in the top station, and in this way the carriage with its suspended car mounts up the slope to the summit. The car holds sixteen persons and weighs about four tons. A 50 horsepower electric motor drives the cable drum, and it receives current from a mountain hydraulic station.—*Electrical Review, London.*

Leave the Electric Wiring Alone

Why is it that a man who would call in a carpenter to hang a door, who would summon a plumber to put a new valve in a faucet, will not hesitate to repair the electric wiring?

It is a fact that most of the accidents resulting from electric wiring would never have occurred had the wiring remained just as it was installed by the electrician.

Houses are wired by competent electricians, who take every precaution to guard against any leakage of current, any places where the electricity can leave the wires and cause trouble. This wiring is always finally inspected by the insurance authorities, and if it is left just as it is installed there is not the slightest danger of accidental "shocks," "shorts" or fires from crossed wires.—*Electrical Advertiser.*

Bakelite

This is the name, derived from that of its inventor, Doctor Bakeland, of that substitute for gutta percha, ebonite, celluloid, amber and other insulators. It is produced through the condensation of formaldehyde and phenol. It is held to be an electric insulator of the first rank, insoluble in all ordinary dissolvents, and not melting at high temperatures. In chemical constitution it closely resembles Japanese lacquer, the composition of which has always been more or less of a mystery.

NEW BOOKS

CARE AND OPERATION OF AUTOMOBILES. By Morris A. Hall. Chicago: American School of Correspondence. 1912. 134 pages with 118 illustrations. Price, $1.00.

This book aims to give the automobile owner who possesses some mechanical instinct and the proper equipment of appliances and tools such instruction as will allow most of the aggravating simple repairs to be made at home with the least expense and delay.

THE GASOLINE AUTOMOBILE. By Victor Lougheed and Morris A. Hall. Chicago: American School of Correspondence. 1912. 298 pages with 276 illustrations. Price, $2.00.

A treatise designed to meet a need for an authoritative and readable presentation of the essential elements of the gasoline motor and its attachments, a discussion of the newer features of the modern car and helpful suggestions regarding road and home repairs.

WIRELESS TELEGRAPHY AND WIRELESS TELEPHONY. By Charles G. Ashley and Charles B. Hayward. Chicago: American School of Correspondence. 134 pages with 93 illustrations. Price, $1.00.

A practical and understandable presentation of the subjects noted in the title of the book, beginning with the earliest development and concluding with the present apparatus.

On Polyphase Subjects

POPULAR ELECTRICITY MAGAZINE'S SWORN STATEMENT

Statement of ownership, management, etc., of Popular Electricity Magazine, published monthly at Chicago, Ill., required by act of August 24, 1912.

Note—This statement is to be made in duplicate, both copies to be delivered by the publisher to the postmaster, who will send one copy to the Third Assistant Postmaster General (Division of Classification), Washington, D. C., and retain the other in the files of the post office.

Editor—Henry Walter Young, 54 W. Lake St., Chicago.
Business Manager—F. W. Harvey, Jr., 54 W. Lake St., Chicago.
Publisher—Popular Electricity Publishing Company, 54 W. Lake St., Chicago.

Owners: (If a corporation, give names and addresses of stockholders holding one per cent or more of total amount of stock.)

E. J. Doyle, 54 W. Lake St., Chicago.

In regard to Section 2 of the law, Popular Electricity Magazine does not accept payment for any editorial or other matter printed in its reading pages.

Known bond holders, mortgagees, and other security holders, holding 1 per cent or more of total amount of bonds, mortgages, or other securities.

There are no bonds, mortgages or other securities outstanding against Popular Electricity Publishing Company.

(SIGNED) F. W. HARVEY, JR., Business Manager.

Sworn and subscribed before me this 30th day of September, 1912.

(SEAL.) RICHARD MUELLER, Notary Public.

(My commission expires May 25, 1915.)

Thomas A. Edison Honored

The formal opening of the New York Electrical Exposition and Automobile Show on October 9th was marked by a function of unusual interest and significance.

Thirty years ago there occurred an event the far-reaching importance of which to the world may well be considered as the beginning of a new epoch in the history of human progress and civilization. This event was the starting of the first central station in New York by the Edison Company on September 4, 1882, thereby commencing the demonstration of the practical and commercial central station system of generating, regulating, distributing and measuring electric current to be used for light, heat and power. It was to celebrate the thirtieth anniversary of this momentous event, and to do honor to Thomas A. Edison, whose work and inventions were embodied in this pioneer station and have since proved to be the foundation and cornerstone of the stupendous electric development that has taken place, that the New York Edison Company tendered to him a formal luncheon on the opening day of the exposition.

The function took place upon the balcony floor of the Grand Central Palace, and was attended by about 400 of the leading electrical, financial and mercantile men of the industry, and numerous distinguished guests.

A large space of the balcony floor of the exposition building had been fenced

around with a trellis which was beautifully decorated with autumn foliage. Within this enclosure were four long tables, each seating 100 guests. The decorations on the tables were also of beautiful autumnal flowers and foliage.

At the center of Table A sat Mr. J. W. Lieb, Jr., vice president of the New York Edison Company. At his right sat Mr. Thomas A. Edison, and on his left Mr. Edward H. Johnson; at Mr. Edison's right sat Mr. Samuel Insull of Chicago, and at Mr. Johnson's left Mr. Arthur Williams of the New York Edison Company. The Edison veterans were seated at both sides of the table in the immediate proximity of those already mentioned. At the back of the guest of honor was the word "Edison" in electric lights.

There were among the guests not less than 20 of the men who were associated with Mr. Edison when he started the First Central Station in 1882. Of these, six are still in the New York Edison Company's employ, and were especially named in Mr. Lieb's speech.

Among the other pioneers present, but not now connected with the New York Company, were: W. S. Andrews, Charles S. Bradley, H. M. Byllesby, W. I. Donshea, Charles L. Edgar, F. S. Hastings, William J. Hammer, John W. Howell, Wilson S. Howell, Robert T. Lozier, T. Commerford Martin, William H. Meadowcroft, Frank J. Sprague, Robert M. Searle and Dr. Schuyler S. Wheeler.

Thirty years ago all of them were humble beginners in the industry, pinning their faith to a possibly great future, and drawing but small salaries or wages when the little station on Pearl street, New York, was started.

When the guests were seated and before the lunch was served, the exercises of the afternoon were opened with an original poem by W. J. Lampton, which was read by the well known actor, Robert Lorraine, and was greeted with much applause.

After luncheon the story of the old and the new was given in an interesting speech by Mr. Lieb, after which Mr. Insull made a short address in behalf of Mr. Edison.

Signs Needed in Mexico City

One of the readers of this magazine, writing from Mexico City, announces the need of enterprising electric sign dealers there. He says:

"In Mexico City, a modern commercial and industrial center, with a population of over 500,000 inhabitants, where mercantile operations of every nature are pursued, and competition is a notable feature, it is surprising to notice the lack of electric illuminating advertising signs and novelties, notwithstanding there are several concerns who have an annual expenditure of something like $100,000 for advertising alone. The fact of the matter is, no manufacturers of electric signs have made any worthy effort to extend their trade in this section. The people are enterprising and ever alert for trade novelties and advertising contrivances, and there is a competitive rivalry among manufacturers of beer, cigarettes, mineral waters, etc., which is a condition that offers excellent opportunities for advertising propaganda.

"At least 20 per cent of the population of Mexico City are foreigners, representing every nation of the globe, which causes an amicable national emulation for supremacy with regard to the representation of their native products, a condition which affords a grand occasion for the introduction of novelty electric advertising illuminating signs."

A subscriber had called a number several times and each time received the busy signal. After a short time he again called and said: "Say, operator, for goodness sakes, ain't dot line empty yet?"

* * *

A prospective buyer of copper stock went to visit the mining camp and on approaching the hotel was amazed to read the sign as follows:

"Fifth Avenoo Hotel. Rooms Singles or En-soot. Private Wash Pan, Soap and Towel for Bawth Two Dollars a Day Extry. Mannycuring and Massaging Done in Kitchen if the Cook has Time. Silk Nightgowns to Let. Guests Kindly Report any Inattention and Some One will be Shot."

* * *

"How does it happen that you are five minutes late at school this morning?" the teacher asked, severely.

"Please, ma'am," said William. "I must have overwashed myself."

* * *

Two suffragettes were met together, and the one had a grievance against the other.

"I am told," she said, severely, "that you allow your husband to carry a latchkey. Is it possible?"

"Yes," answered the other, with an indulgent smile. "I do let the poor boy carry a latchkey, I must admit. But it doesn't fit the door. I just let him carry it to humor him. He likes to show it to his friends, you know, and make them think he's independent."

* * *

"Aye vant a ticket to Gothenburg."

"When do you want to go?" asked the clerk in an impatient tone."

"Aye vant," she said with simple directness, "to go van the boat starts."

* * *

Woman Passenger—"Conductor, why is the train standing here so long? A hot-box? It's funny you never discover these things before the train starts!"

* * *

A foreigner calling Lincoln 7508 gave the order in very broken English as "Lincoln 75, nothing in the middle, then 8."

A small boy who was enjoying his first trip to the country stood for several minutes watching a large windmill in the vicinity of the barn. Finally he ventured. "Gee, mister, you've got a fine electric fan for your pigs."

* * *

Once upon a time an Irishman was walking through a lonely cemetery and stopped before an imposing looking monument bearing the following inscription: "I Still Live."

Pat reflected soberly for a moment and then said, "Well, if Oi was dead, begorra, Oi'd own up to it!"

* * *

"So you want to marry my daughter?" "Yes, sir." "Got any money saved up?" "Yes, sir." "Could you let me have $5,000 on my unsecured note?" "I could, but I wouldn't." "I guess you can take care of her all right. She's yours, my boy, and here's a five cent cigar."

* * *

"Susannah," asked the preacher, when it came her turn to answer the usual question in such cases, "do you take this man to be your wedded husband, for better or for worse—"

"Jes' as he is, pahson," she interrupted, "jes' as he is. Ef he gets any better Ah'll know de good Lawd's gwine take him, an' if he gets any wusser, w'y, Ah'll ten' to him myself."

* * *

Two little children, being awakened one morning and told that they had a new little brother, were keen, as children are, to know whence and how he had come.

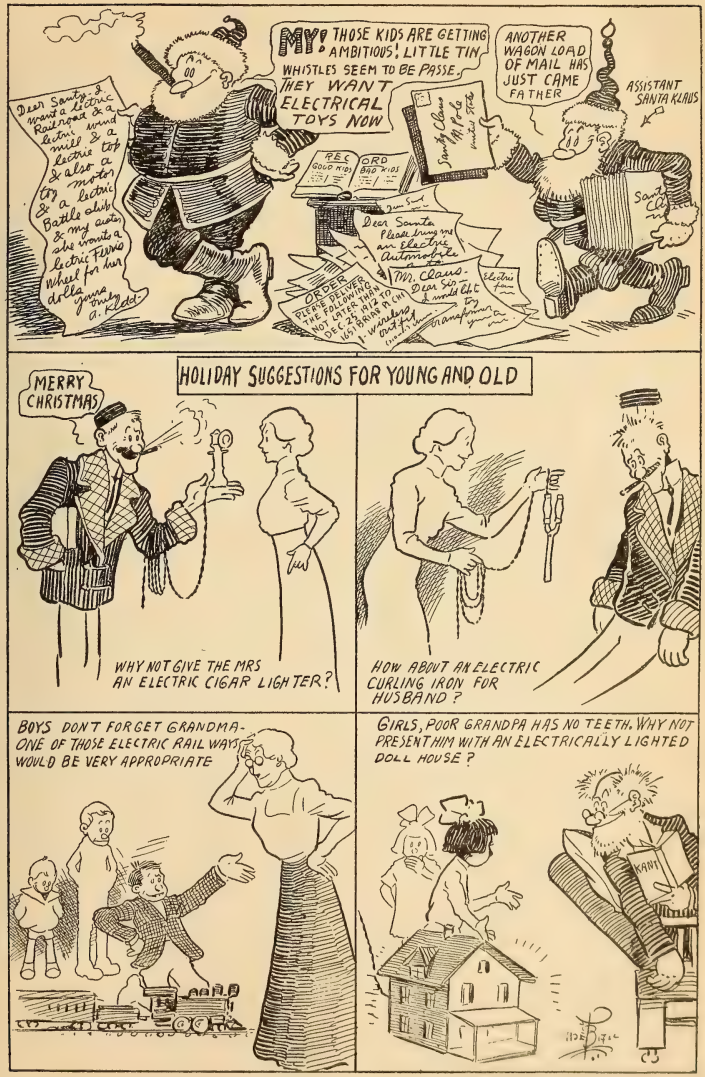
"It must have been the milkman," said the girl.

"Why the milkman?" asked her little brother.

"Because," replied the sister, "it says on his cart, 'Families supplied.'"

* * *

A psychologist came upon a hard working Irishman toiling, bareheaded, in the street. "Don't you know," said the psychologist, "that to work in the hot sun without a hat is bad for your brains?" "D'ye think," asked the Irishman, "that Oi'd be on this job if Oi had any brains?"

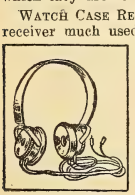

Dear Santa, I want a Electric Railroad & a Electric wind mill & a Electric top & also motor Cy & a Electric Battle ship & my auto, she wants a Electric Piano & wheel for her dolla yours truly a. Kidd
MY! THOSE KIDS ARE GETTING AMBITIOUS! LITTLE TIN WHISTLES SEEM TO BE PASSE. THEY WANT ELECTRICAL TOYS NOW
ANOTHER WAGON LOAD OF MAIL HAS JUST CAME FATHER
ASSISTANT SANTA KLAUS
Dear Santa, Please bring me an Electric Automobile & a
Mr. Claus- Dear Sir I wish the
ORDER
PLEASE DELIVER THE FOLLOWING NOT LATER THAN TO-DAY
HOLIDAY SUGGESTIONS FOR YOUNG AND OLD
MERRY CHRISTMAS
WHY NOT GIVE THE MRS AN ELECTRIC CIGAR LIGHTER?
HOW ABOUT AN ELECTRIC CURLING IRON FOR HUSBAND?
BOYS DONT FORGET GRANDMA- ONE OF THOSE ELECTRIC RAIL WAYS WOULD BE VERY APPROPRIATE
GIRLS, POOR GRANDPA HAS NO TEETH. WHY NOT PRESENT HIM WITH AN ELECTRICALLY LIGHTED DOLL HOUSE?

Common Electrical Terms Defined

In this age of electricity everyone should be versed in its phraseology By studying this page from month to month a working knowledge of the most commonly employed electrical terms may be obtained.

WALL BRACKET.—A bracket used in attaching electric wires to the wall of a building into which they are to run.

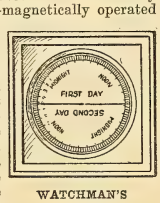
WATCH CASE RECEIVER.—A type of telephone receiver much used with wireless telegraph receiving sets. It is sometimes called a "pony" receiver. Being small and compact, it is readily attachable to the head band which holds it to the ear of the operator. (See cut.)



WATCH CASE RECEIVER

WATER AND WIND LINE.—A place on telegraph poles close to the ground at which decay generally begins to take place.

WATCHMAN'S CLOCK.—In some watchman's clocks a paper dial is caused to revolve slowly over a number of electro-magnetically operated punches. Each electro-magnet is connected to a station in some part of the grounds or place that the watchman visits periodically. At each visit the watchman uses a key to close an electric circuit, or in some systems turns a magneto located at the place, this causing the proper electro-magnet at the paper dial to punch a hole. This hole indicates the station turned in and the time of the watchman's visit. (See cut.)



WATCHMAN'S CLOCK

WATERPROOF GLOBE.—An outer globe for incandescent lamps to protect them from water. (See cut.)

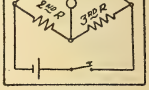
WATERPROOF GLOBE

WATER LEVEL ALARM.—An alarm having its circuit closed by a change in the level of the water in a tank or boiler. A float is used to accomplish the operation of bringing the contacts together.

WEDGE CUTOUT.—See Spring Jack.

WELDING TRANSFORMER.—The induction coil or transformer used in electric welding. The primary of such a transformer consists of a great number of turns of relatively small wire while the secondary may be only one turn of a large copper bar.

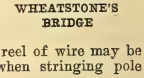
WHEATSTONE'S BRIDGE.—A system of three known resistances connected in such a manner that a third unknown resistance may be connected in on the fourth side (see cut), and its resistance found by adjusting the three known resistances until no current flows through the galvanometer on closing the key. Then by proportion the first resistance is to the second as the unknown resistance is to the third resistance.



WHEATSTONE'S BRIDGE

WIRE BARROW.—A hand barrow upon which a reel of wire may be placed and moved about when stringing pole lines. (See cut.)

WIRE GAUGE.—A steel disk having at intervals around its circumference slots corresponding to the different sizes of wires. The wire to be measured is tried in the slots until one is found into which it fits snugly. The size is then read under the slot on the gauge.



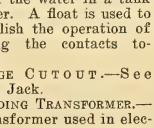
WIRE BARROW

WIRE FINDER.—A galvanometer used to identify the end of a given wire in a cable.

YOKE.—In an electro-magnet it is the piece of iron which connects the ends farthest from the poles of the two portions of the core on which the wire is wound.

ZERO POTENTIAL.—The electrical condition of the earth is considered as zero; that is, a voltmeter connected to a known source of electric pressure and with the other terminal to ground would show a deflection of its needle equal to the full voltage of the source.

ZINC.—A metal much used in electrical work. Its principal uses are to serve as the positive plate of voltaic batteries and as the spark gap terminals of wireless sending sets. Its specific gravity is 6.8 to 7.2. Its resistance is 3.7 times that of silver, which is one.



DETECTOR CRYSTALS

ZINCITE. — A mineral zinc oxide, used in the form of a crystal to make wireless detectors. The crystals are set in a cup and upon one of these is brought down lightly a crystal of chalcopyrites, making a delicate contact. (See cut.)

ZIRCONIUM.—A mineral crystal used in wireless telegraph detectors.

POPULAR ELECTRICITY MAGAZINE

In Plain English

HENRY WALTER YOUNG, Editor

Vol. V | January, 1913 | No. 9

CONTENTS

	Page
WHERE A QUART OF WATER EQUALS A HORSE POWER OF ELECTRICITY	881
Sanitary Strap for Street Cars	883
Searchlight Aiming Device	884
Light of the Firefly	885
Lightning and Petroleum	885
A MATTER OF ACHIEVEMENT	885
SAVING THE FUR SEAL MOTHER	894
Overhead Construction in France	896
Power Crane in Gravel Handling	897
Record Breaking Reel of Wire	897
Finish for Electric Fixtures	898
Telephone Service to Docked Vessels	898
A Castle on a Trolley	899
Freak Ordinance	899
Pearl Lightning	899
THE HIPPODROME AND ITS ELECTRICAL STAGE EFFECTS	900
Weed Burners and Electric Railways	905
Fountain of the "Peace Palace" at Washington	906
Besmirching the Skies	907
Curious Fact of Lightning	908
Funeral Car in France	909
Nursery Noise Indicator	909
THE VALUE OF ENGLISH TO THE TECHNICAL MAN	910
Collapse of a Steel Transmission Tower	912
Traveling Spot Light in a German Theater	912
Electricity at Crescent Farms	913
Signaling between Dispatcher and Motorman	914
American Equipment in Japanese Mines	915
Edison's First Principles still Followed	915
Harvard Stadium Station	916
The Evaporation of Metals	917
An Electrical Steering Sentry	917
ELECTRIC WASHING MACHINES NEEDED IN THE PHILIPPINES	918
First School for Telephone Operators	919
The Hot Air Douche	920
Mouse Ties up Street Car System	920
The Conductors Transformation	921
Electrical Resistances at Very Low Temperatures	921
Coal Mining in Australia	922
Storage Battery Cars Operated in Trains	923
Curious Case of Electric Shock	923
Portable Floor Light	924
Electric Circus-Train	924
Movable Laboratory for Air Surveys	925
Lightning Rods to Protect Threshing Machines	926
Stor ge Battery in a Cake of Ice	926
Street Indicator for Electric Cars	926
Vibrating the Whole Body	927
Ventilated Telephone Booth	927
A Blue Print Machine	928
The Golden Arc Light	928
Adding Charm to the Picture	929
Puppies Appreciate Warming Pad	929
WHEN A UNIVERSITY HOLDS OPEN HOUSE	930
Heated Glove for Auto Drivers	932
Electrically Heated Baptismal Fount	932
Cut Glass Electrolier and Vase	933
Projecting Images of Opaque Objects	933
Electric Car for Maintenance and Lamp Trimming	934
Electric Railway without a Trolley	934
Loud Speaking Telephone at Ball Games	935
Mountaineering in an Electric	936
Electrolytic Copper Refining in Norway	937
AIDS TO NAVIGATION ON THE PANAMA CANAL	938
Manila's New Hotel	941
Street Car Safety Device	941
ELECTRICAL MEN OF THE TIMES, ROBERT F. PACK	942
Long Run of an Electric Car	943
Measuring Wind Velocity	943
A Plant in the Bush Land	944
The White Way and the Chickens	944
Farm Lights and Farm Motors	945
Electrical Interests of Women	
The Blue Bird	946
EDISON'S TWENTIETH CENTURY HOUSE	948
The Cozy-Glow	952
Electric Saute Pan	952
The Dream of Elias Howe	952
Dressing the Hair	953
Effects of Artificial Light on Hangings	953
Junior Section	
Midnight Ride of a 48-Ton Generator	954
The Man Behind the "Movies"	955
Giraffe Telephonia	956
Cylindrical Lighting	956
Telling the Time at Night	957
Birds and the Wireless	957
To Make an Electrophorus	958
Line Patrolman and His Home	959
Commended for Telephone Enunciation	959
The Wizard Lead Pencil	959
Flasher Display at Fire Chief's Meet	960
Novel Use of Electric Current	960
Five Hundred Fifty Volt Fishing	960
Popular Electricity Wireless Club	
Wireless Signals Registered by Frog Muscles	961
Wire'ess Unit Time in Germany	962
Wireless for Submarines	963
FORMALITIES TO BE OBSERVED IN CONNECTION WITH THE NEW WIRELESS LAW	964
Questions and Answers in Wireless	966
Directory of Wireless Clubs	970
For Practical Electrical Workers	
Construction of a 50 Watt Dynamo	970
To Make Bell Strike the Hours	975
Tool Chest Lock and Alarm	976
Ground and Short Circuit Tester	976
New Portable Electric Drill	977
Fuse and Trouble Tester	977
How to Read Motor Performance Curves	978
Variable Low Voltage Transformer	979
Electrolysis of Water	979
An Illuminated Gun Sight	980
Mail Box Alarm	980
An Ingenious Safety Device	980
Chopping Bowl Reflector	981
Book of Mystery	981
Emergency Strain Insulator	981
A Trolley Wire Fastener	982
Improved Carbon Holder for Moving Picture Machine	982
Removal of Oil from Condenser Water	982
Portable Egg Tester	983
Door and Window Alarm Contracts	983
Open Circuit Telegraph Line	983
Knife Blade as Eye Magnet	983
The Aerial Bridge in Miniature	984
Electric Advertising in Clock Case	985
"Save a Dollar" Window	985
Advertisment on Lamp Globe	985
Hat Cleanser's Advertisement	986
Fly Chaser for the Baker's Window	986
The Anti-Window-Steamer	986
Miscellaneous	
ELECTRO-CHEMISTRY AND PROMISES IT HOLDS FORTH	987
Windows Artifically Lighted	988
ELECTRICAL SECURITIES	989
Bonds—The Ideal Investment	991
SCIENCE EXTRACTS FROM FOREIGN JOURNALS	993
New Books	996
Combination Electric and Oil Lamp	996
How Electric Ware is Constructed	996
Which is Your Telephone Ear	997
Coal Output Doubles Every Ten Years	997
Storing the Electric Fan	997
Short Circuits	998
Electric Current at Work	
Automatic Typewriter	1000
Automobile Self-Starter	1001
New Kind of Insulating Glove	1001
Brain Versus Brawn	1002
Electric Speed Indicator	1002
Meat Slicing Machine for Butchers	1003
A Forge Blower	1003
Pressing Iron Economy	1004
Electric Perfumer and Disinfector	1004
Kerosene Torch	1005
An Office Ventilator	1005
New System of Electric Number Signs	1006
General Utility of the Modern Searchlight	1006
A Regulating Socket	1006
For the Man Who Shaves Himself	1008
English Blue Print Machine	1008

RENEWALS When your subscription expires, you will find a renewal blank enclosed here. You should fill out and return with remittance at once to avoid missing a number. Positively no copies will be mailed on any subscription after same expires unless renewed, and we cannot agree to begin subscriptions with back numbers. The date on wrapper of your magazine shows issue with which your subscription ends. The extension on this date to period covered by renewal is sufficient receipt. If any other is desired it should be requested at time of renewal.

CHANGE OF ADDRESS Notify us promptly of any change in your address, giving both the old and new locations. Since mailing list for each issue closes the 5th of the preceding month (i. e., list for February closes January 5th), changes received after the 5th must necessarily take effect with issue for second month following. Postmaster as well as Publisher should always be notified of changes in order to forward mail sent to old address.

ISSUED MONTHLY BY POPULAR ELECTRICITY PUBLISHING CO., Commercial Bldg., Chicago, Ill.
YEARLY SUBSCRIPTION, $1.50; CANADIAN, $1.85; FOREIGN, $2.25; SINGLE COPY, 15 CENTS
No additional copies will be sent after expiration of subscription except upon renewal.
Entered as Second Class Matter April 14, 1908, at the Post Office at Chicago. Under Act of March 3, 1879.

Copyright 1912, by Popular Electricity Publishing Co.

THE PROBLEM OF TRANSPORTING HEAVY ELECTRICAL APPARATUS TO PLACES WHERE NEEDED IS A HARD ONE WHEN THE PLACE OF INSTALLATION IS AWAY FROM A RAILROAD. THE ILLUSTRATION SHOWS THE FRAME CASTING OF A 700 HORSE POWER MOTOR BEING HAULED A DISTANCE OF FOUR MILES FROM THE RAILROAD TO THE PLANT OF A BRITISH COLUMBIA COPPER MINING COMPANY. THE WEIGHT OF THE CASTING IS 34,000 POUNDS. NO WHEELS AVAILABLE COULD SUPPORT THE WEIGHT SO IT WAS HAULED ON RUNNERS AND AT A TIME WHEN SNOW WAS ON THE GROUND

Popular Electricity
In Plain English

VOL. V. JANUARY, 1913 No. 9

Where a Quart of Water Equals a Horse Power of Electricity

BY GEORGE F. WORTS

To the lay mind, hydro-electric service would seem highly difficult if not actually impossible in a section of the country where the thermometer, during the winter months, often registers 30 and 35 degrees below zero and, so it is said, the first flake of snow remains until spring; curious though ample proof of the severity of the winters.

However, so hydro-electric authorities assert, such contingencies as might be expected to result from the above conditions are avoided by the use of large reservoirs with an aggregate capacity sufficient to supply the generators throughout the winter.

The turbines furnishing electricity to Duluth, Minn., and her subsidiaries are actuated through a water head of 375 feet—the greatest head of water commercially available east of the Rocky Mountains. From this fall it is estimated that a quart of water per second at the water gate will furnish one horse power of energy in Duluth. A secondary, or auxiliary system, of 70 feet still remains to be developed; making a total available head of 445 feet, over twice the distance of the fall of Niagara's waters, although the grandeur of Niagara is lacking.

Five years ago, the largest water turbine then in existence was installed in the Great Northern Power Company's plant on the St. Louis River at Thompson, Minn., thirteen miles from Duluth; today 40,000 horse power is available, while at least double that still remains to be harnessed.

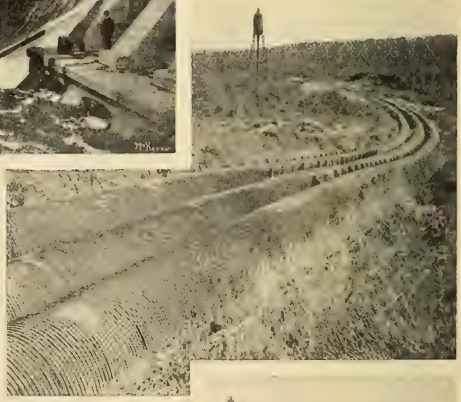
The great reservoir at Thompson has a capacity more than enough to supply the customers' wants during the extreme winter season.

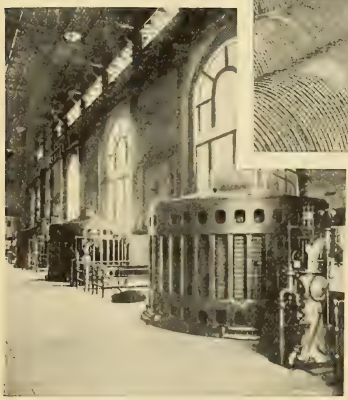
Leaving the reservoir, the water flows through a canal two miles in length and from there is carried a distance of one mile by three pipe lines constructed of California red wood. These conduits, which are each seven feet in diameter—large enough to drive a horse and buggy through—deliver the water to the blades of the turbines in the power house located on the lower level of the river.

A unique feature of the installation just before the water arrives at this point, is a standpipe, the function of which deserves comment. The standpipe is a mammoth concrete and steel affair, rearing to a great height—several feet above the level of the reservoir—and is directly connected to the conduit lines.

In order to understand the function of this standpipe, let us consider one phase of the use of electric power which has assisted materially in placing Duluth next in rank to New York City in the number of tons of freight entering and leaving annually and which has a particular bearing upon the subject in hand.

Here alternating current was first applied to unloading apparatus.





VIEW OF THE GREAT NORTHERN POWER COMPANY'S DEVELOPMENT ON THE ST. LOUIS RIVER, THOMPSON, MINN.

At the largest coal docks 1,000,000 tons are unloaded yearly, a sharp contrast to the 200,000 tons of five years ago. Huge electric motors at these docks will oftentimes throw an instantaneous load on the line of 8,000 horsepower. Consequently the line is drained and the prime mover—the water in the conduits at Thompson—is seriously taxed. At this juncture the mission of the standpipe becomes evident.

The natural tendency of water is to seek a common level. Manifestly the surface of the water in the standpipe is equal to that in the reservoir, thereby developing the same pressure as the 375 feet of normal head. When the sudden load of 8,000 horse power is thrust upon the great, vibrant transformers at Du-

luth, back over the threads of copper upon the quiet spinning turbines, the pipes cannot supply water fast enough and the reserve power of the standpipe is automatically tapped. When the load diminishes, the tank again fills to a level corresponding to that of the dam.

Between the standpipe and the turbines are automatically actuated valves to regulate the flow of water to the wheels.

From the low-humming generators, the current is stepped up in transformers to 33,000 volts and transmitted by a steel tower line thirteen miles to the distributing station at Duluth. Here the current is stepped down for local consumption and delivered to "wholesalers" in modified forms in Duluth, and also to Superior, Wis., via submarine cable under the St. Louis River where it emerges to join the sparkling, emerald waters of Lake Superior.

A point of interest worthy of mention in passing, is the method used to cool the immense transformers here employed to lower the voltage of the current. The coils of copper wire encircling the heavy iron core, constantly impressed by the tremendous current, would soon heat to redness if some adequate steps for cooling them were not taken. Hundreds of gallons of a special oil are circulated through the windings and piped out to cooling tanks from which it returns to complete the cycle. The old method of cooling consisted of pumping water through coils of pipe submerged in the oil. The new method was given its initial commercial trial in the Duluth station and has since been adopted extensively elsewhere.

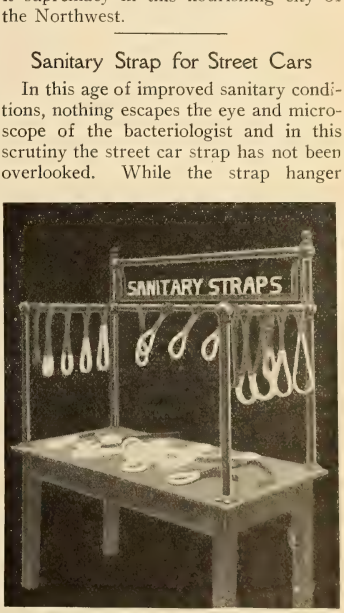
Why the rates for current are so low in these parts—lower, even, than at Niagara where there is no competition whatsoever—has the following interesting explanation:

Previous to the advent of the Great Northern Power Company, all large manufacturers using electric current were compelled to generate it themselves by private power units. The Great Northern Company's rates then, in order to be attractive were necessarily lower than the bare cost of similar production in the private units—not taking into consideration overhead, interest, etc.

Electricity is used entirely in pumping the municipal water supply and in nearly all mechanical processes where electricity and steam compete, the countless advantages of the former are rapidly gaining it supremacy in this flourishing city of the Northwest.

Sanitary Strap for Street Cars

In this age of improved sanitary conditions, nothing escapes the eye and microscope of the bacteriologist and in this scrutiny the street car strap has not been overlooked. While the strap hanger



AN EXHIBIT OF SANITARY STREET CAR STRAPS

grips the strap his hand comes in contact with millions of bacteria, so health departments tell us. But along with this discovery comes the Rico sanitary strap. Bacteria cannot make a home upon it for its surface is of polished enamel and therefore readily cleaned and kept clean. The strap is made to cover old straps or to replace entirely the old leather type.

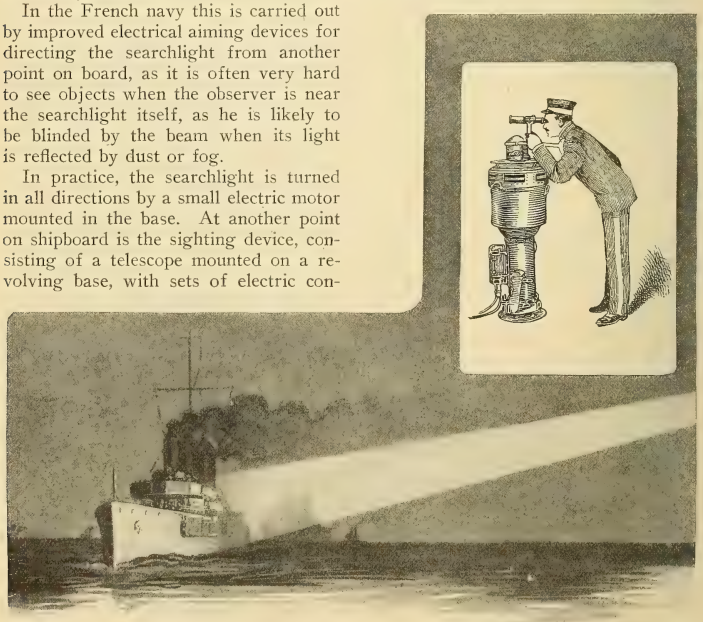
Searchlight Aiming Device

It is true that a battleship is protected against the approach of torpedo boats by exploring the sea with the searchlight in all directions, but the light also shows the position of the vessel to the enemy and serves to attract the torpedo boats. For this reason it is now the rule to use a masked light and to turn on the beam just at the moment when the searchlight has been pointed to an object at sea. In this way the beam does not risk being directed upon another vessel of the home fleet so as to reveal its presence to the enemy, and in general the idea is to keep the beam from sweeping over the field of operations and to unmask it only when it is actually needed.

In the French navy this is carried out by improved electrical aiming devices for directing the searchlight from another point on board, as it is often very hard to see objects when the observer is near the searchlight itself, as he is likely to be blinded by the beam when its light is reflected by dust or fog.

In practice, the searchlight is turned in all directions by a small electric motor mounted in the base. At another point on shipboard is the sighting device, consisting of a telescope mounted on a revolving base, with sets of electric contacts placed so that inclining the telescope or revolving the base will send different electric currents in the circuits which run to the searchlight. The device is so adjusted that any movement of the telescope gives exactly the same movement to the searchlight, and then the light can be unmasked by an electric shutter so as to send the beam in the proper direction.

Often the position of the enemy can be distinguished in the night, and the sighting is first done by the telescope, then the searchlight is thrown on at the time when it is thought fit. By the present method the operator thus has complete control of the light.



Light of the Firefly

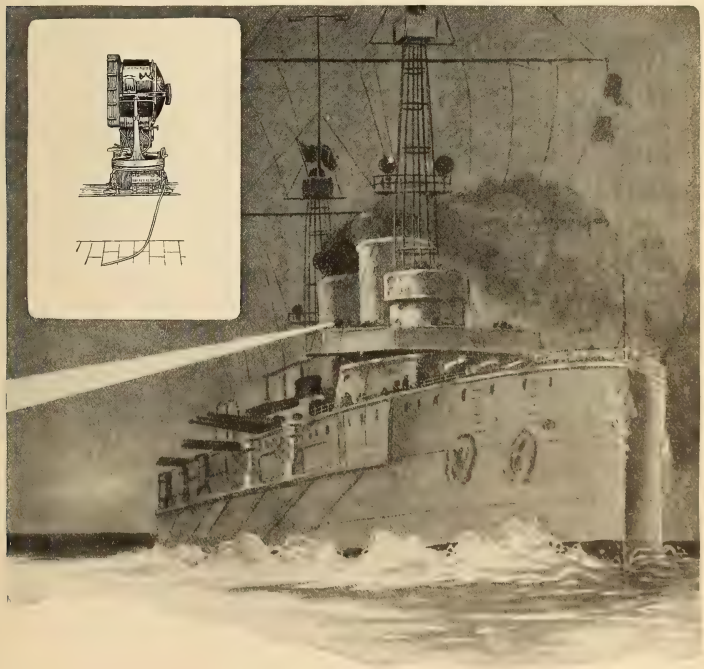
Recently some measurements have been made on the brightness of the light of the firefly. This of course is not the first time that scientists have turned their attention to this interesting insect commonly known as the "lightning bug." Men have tried for years to wrest the secret of light production from the firefly, but so far have been unsuccessful.

Even though we do not know how the light is made it is of interest to learn just how much area of the brightness of the firefly's body would be required to give sufficient light to replace a tungsten lamp in an ordinary room. The measurements indicate that if one-fifth of the ceiling area in an ordinary room was closely covered with glowing fireflies the resulting illumination would be sufficient for ordinary activities. We have everything but the secret!

Lightning and Petroleum

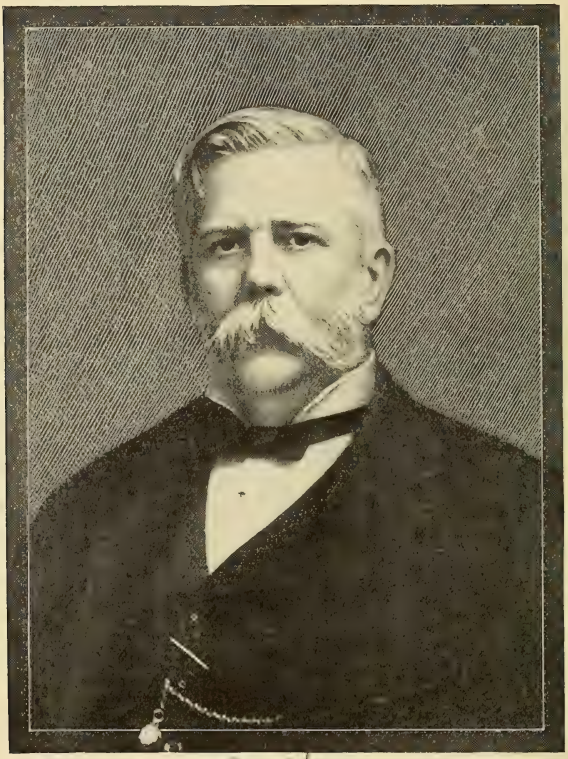
For four months certain of the petroleum wells at Boryslaw, Galicia, fired by a violent thunder storm, burned like torch flames 40 to 50 feet in height.

It is said that no less than five wells are struck by lightning every year at Boryslaw, the cause being ascribed to the obligatory use of sheet iron coverings for all the installations. The iron surfaces communicate with the system of metallic tubes, thus forming, during a thunder storm, a sort of Leyden jar, which provokes lightning strokes.



A Matter of Achievement

By H. Bedford-Jones

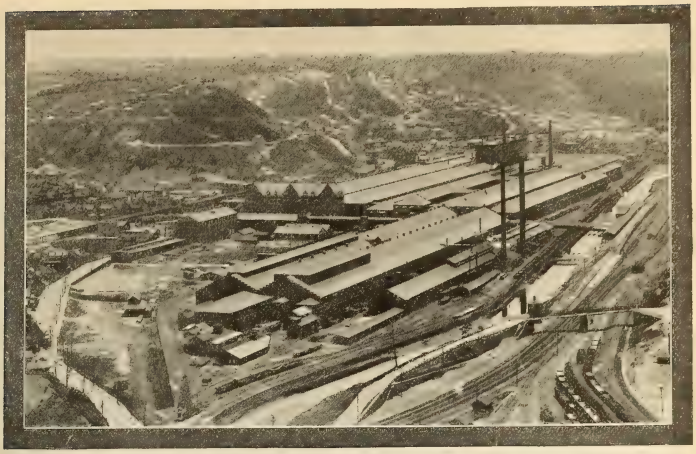


GEORGE WESTINGHOUSE

Up at the Press Club of Chicago we have some enjoyable evenings. Once in a while a few very noted men will drift together from the ends of the country and will remodel this sorry scheme of things to their hearts' desire. The remarkable part of it is that they can command an audience!

Men like Opie Read, Will Comfort, Captain Jack, Jay Cairns—all more or less literary—ever gather hearers unto themselves. Their causeries are worth while, because such men stand for achievement, not for time wasted.

Time killers are usually proud of the fact that they have nothing to be



WORKS OF THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, ONE OF THE GROUP OF WESTINGHOUSE INTERESTS CENTERED IN THE VICINITY OF PITTSBURGH

proud of. Men who have achieved things in the world, interest the world. Industries which have achieved things, also interest the world. The imitators of a man mark his worth in the world's esteem. The imitators of an industry mark its worth in the world's bankbook. Only big things can be imitated. Smaller things are copied.

When George Westinghouse began to use the alternating current for electric lighting, his business grew with amazing rapidity. Today you can follow the Turtle Creek valley, just outside Pittsburgh, for five miles and meet new Westinghouse factories all the way. Each is a distinct entity, a company separate in itself; but each was founded by the genius of this single man. His products are too big to be copied; they can only be imitated, these days.

The name of Westinghouse stands for achievement. After all, a coat of arms counts for very little unless you win it yourself. Perspiration is the blazonry of success.

When I got off the train at the Westinghouse Electric and Manufacturing Company factory, I found myself standing on a huge bridge. This seemed to lead into a smoke-maze of buildings, but as I walked along it proved to have various side vents, opening on this or that factory; the end of it proved to be my goal. And I had thought I was coming to a mere electric works!

As I passed along I could look down into the yards and see machines whose very names I knew not, waiting for shipment. Electric tram cars—storage battery cars, I found later—pushed about, loaded to the guards. Rows of electric locomotives stood ready to go forth. In and out of the buildings ran trains, while the ivy faced brick buildings themselves stretched thin and dark down beside the railroad tracks, offering little promise of the marvels of achievement which they contained. Then I had come to the shops at last.

"There are four rows of girls working here," said my guide as we passed through one of the divisions. "Lined up, they make pretty near an even mile."

"Why, how long is this shop?" I asked in surprise.

"A third of a mile. But wait till you hit the locomotive section. *That's* something like a shop!"

And it was. It was hard to believe that this was a single building where steadily progressive work was performed from end to end. For here, as in some other large factories, the work is based on a system of progression. Each piece goes forward, never backward, gaining a little at each step and ending in the shipping room, a factory in itself.

I was surprised both at finding the large number of women and girls at work in these shops, and at their high standard of intelligence and quality. It seems that the company has found that the female of the species works better than the male, especially on coil wrapping and such work as requires rather delicate handling. Here is an interesting point for other manufacturers, in that working men are apt to tire of their work—it grows monotonous to them and toward the end of the day is in consequence liable to a drop in quality. With women, on the other hand, this is not the case. They remain at a constant level of quality, and keep up to the average output which is required in piece work as well.

But to return to the locomotive shop. Standing at one end of this, it was nearly impossible to see to the other end—almost a solid half mile of enginery under construction and tests, small and large cranes moving massive cast steel from point to point, and the whole forming a study of the application of electricity to machinery in the mass.

The engine room, which furnishes power for the entire plant, is a model power house. Here are all turbine engines, whose capacity of 12,000 horsepower is ample for its needs. Each of the two engine rooms is controlled by a huge eighteen panel switchboard of blue marble. At the time I visited the plant, it was also under the inspection of a number of consulting chemists from the world over. One of these, a Russian, standing near me, was gazing at the switchboard with interest and delight. At length he suggested that the meters should be installed behind the switchboard, out of sight, instead of on its face.

"But why?" asked the puzzled engineer. "That would make us go clear around to read them!"

"Yes," returned the chemist with simple earnestness, "but just think how they spoil the looks of that beautiful marble!"

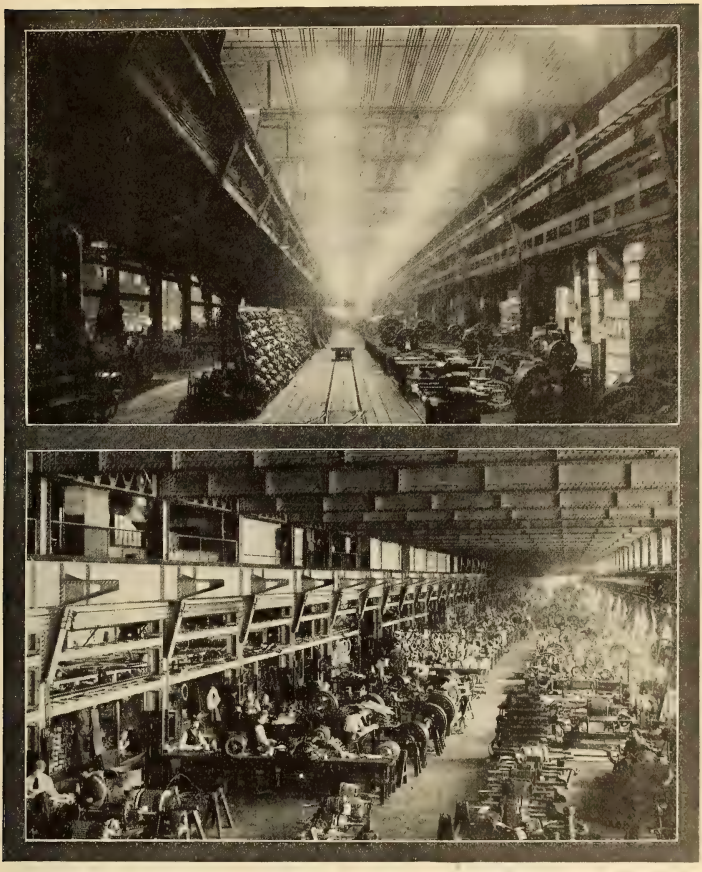
I forget what the engineer said to that.

And yet in some factories such a remark would not be considered inapt. I know of one place where the "beauty shop," as the men call the office corps, might even follow it out.

A rather remarkable point which I observed all through this factory was its striving for better and quicker results, for the elimination of all useless effort. For example, the catalogs and circulars sent out to customers and district sales offices and dealers are composed of separate leaflets, and I took for granted that putting them together in the loose binders involved quite a large force. But I found that it was all done by four girls and a table.

The table is far more important than the girls. It revolves on an axis, being driven by a belt from an electric motor. It has two speeds and may be stopped from any point about its edge. About the table are piled the loose leaflets in consecutive order. As the table revolves the girls simply pick up one leaflet from each pile and place them together in order. This not only eliminates the old method of walking from table to table and so wasting much time and effort, but it does away with about twelve girls, while the regular speed of the table keeps the girls working at a uniform average rate and so prevents any loafing on the job.

In the same way the pay-roll system here is unique, having been evolved after many trials and experiments. The usual factory has pay days every day in the week, for the different sections, the em-



THE UPPER ONE OF THESE SHOPS IS DEVOTED ENTIRELY TO THE BUILDING OF SMALL MOTORS. IN THE LOWER ONE THE WINDING OF ARMATURES PROGRESSES—LITERALLY THOUSANDS OF THE ARMATURES ON THE BENCHES

ployees keeping the pay department busy all the time. But here the 14,000 shop workers are all paid off in fifteen minutes, on a single day. Just before the whistle blows a long belt is unrolled on the floor in each section. This belt is stationary and has numbered squares, from one onwards. Each employee of the section has a number and takes the corresponding place on the belt.

When the whistle signals they go forward to the ticket window and the paymaster simply hands out the envelopes in consecutive order. There is no time

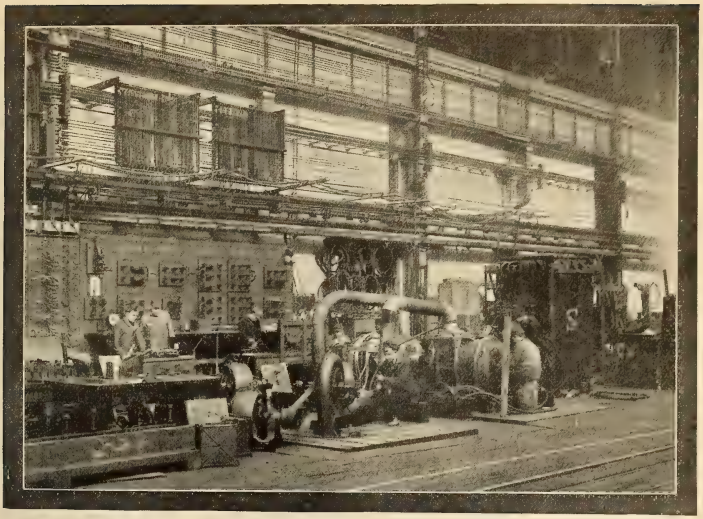
lost hunting for names and numbers—it is simply a matter of handing out the envelopes as fast as they can be received.

With the exception of a few buildings, all the works here are under one consecutive roof, and the various machines are expressions of the most recent advancement in the electrical art. The rectifiers for charging batteries are made amid blue flame and mercury and while each occupies a space only four feet by 20 inches, they are of remarkable interest. This type performs the essential operation of changing the usual alternating current to the direct current requisite for charging batteries.

The rectifier consists of a sealed glass bulb filled with mercury vapor. This is provided with three electrodes, two of graphite or similar material, and the other of mercury. The alternating current voltage is applied to the two solid electrodes and the central point of an auto transformer. The mercury vapor allows the current to pass from the solid electrodes into it but prevents a reverse flow. The result is a continuous current from this mercury vapor tube out into the circuit and back again. This current is made up of the two halves of the alternating current wave, passing alternately from the solid electrodes into the mercury, and then out as direct current.

But a distinctive Westinghouse product, made at no other place in the world, and of singular interest, is the reduction gear for steam turbines. This, while not distinctly electrical, has nevertheless a wonderful part in turbines, and is attractive to all electricians. Some form of gear to work between a marine turbine and the propeller it drives was for a long time considered impossible. But to make full use of the possibilities of the steam turbine such a gear was necessary, for a propeller cannot be driven

A VIEW IN THE ELECTRIC LOCOMOTIVE SHOP—A SOLID HALF MILE OF ENGINERY UNDER CONSTRUCTION AND TESTS. HERE ARE BUILT SOME OF THE LARGEST LOCOMOTIVES IN THE WORLD



A SECTION OF THE TESTING DEPARTMENT. WHEN A PIECE OF APPARATUS HAS ASSIMILATED THE TRIAL DOSES OF CURRENT HERE PROVIDED IT IS NOT LIKELY TO FALL DOWN IN SERVICE

at turbine revolution speed, for in the Westinghouse turbine—the Parsons type—this speed is several thousands of revolutions a minute.

Balanced helical gears in solid bearings were used for small horsepower, but for high power this proved impractical owing to the excessive tooth pressure and wear of the bearings. To overcome the various difficulties, a reduction gear is now manufactured by the Westinghouse Machine Company, just over the bridge from the electric factory.

Here I saw the tremendous pinions in place, working a reduction in revolutions at ratios of from four to one to seven to one, while still higher reduction may easily be obtained. The reduction gear is provided with a floating frame, which supports the pinion. This frame is carried on three pistons, each of which floats on a cushion of oil. This permits the frames to oscillate in a vertical plane and to maintain automatically a uniform distribution of tooth pressures.

Not far from these gears, which are now manufactured on the spot, was set up the original device, made from special forgings by German companies. While this was primarily devised for marine practice, it has also been adopted for driving direct current generators, which in order to avoid commutation troubles must be driven at relatively low speed. It is also applicable to driving pumps and shafting, so that the future holds great possibilities for this wonderful machine control. Nor is there any waste here from loss, an official test of a 6,000 horsepower set having shown an efficiency of 98.5 per cent.

But let us leave the shops and visit the Westinghouse Club, an institution provided for the men of all the Westinghouse companies in general. This is a finer place than many a city club I have

seen. The light, low rooms are tastefully furnished and decorated, and as regards club equipment everything is here; the gymnasium is a magnificent one, well equipped, well lighted,—and well used. In fact it was all so fine that I thought it must be for the officers of the company alone. But my guide showed me the rules, and pointed to the literally nominal dues, and I said no more. This club has but taken advantage of an excellent chance to aid the Westinghouse men both physically and mentally, and in this it seems to have won the cooperation of the men themselves, which is the great thing.

But I was forced to return to the works at length. Here in one section were some fifteen electric locomotives under construction for the Southern Pacific lines. These were to be operated either at 600 or 1200 volts and were designed for freight work, the Southern Pacific being engaged in electrifying certain of its coast lines. By the time this article reaches you, these locomotives will be at work—clear across the continent.

A notable point about some of these engines is that they can be operated by direct or alternating current. This was a special feature, for usually the electric locomotive is made either for the one type or the other.

In another of these long distance shops, running dim into the far end, were piles of smaller motors, such as are here applied to machinery in all its phases. Overhead on each side of the central halls, worked men, women and girls at the smaller details and piece work. This is one thing which the electric motor makes possible. In the old style machine shops the mass of workers had to be kept distinct from the machinery production, owing to the roar and blast of noise and the unhygienic air conditions. But in these shops there was none of this, none of the pallid cheeks and tired faces which one so often observes. All were healthy, cheerful, and busy.

I was surprised to find that the average girl at her machine or her hand work makes by her unskilled labor as much as the average trained girl can make in the more usual women's trades. And surely it is much better to work here among the hills, away from the city grind and roar, where the pay is graded to the amount of work done, than to slave all day long over the typewriter for a weekly pittance! True it is that the piece worker falls into a regular output and often turns out no more than the average required of her, yet none the less there is an excitement about such work, a stimulus which proceeds from getting paid by your work instead of by your time.

Here, as in other places, the old line shaft drive for machinery has given place to individual motor drive. It is only natural that electrical factories should be the first to make use of this system of their own manufacture, but others have wakened up to it the world over. Every machine, tool and motor turned out here is figured down to the last detail of its future work. The rating of the motor is based on its future need, as is the type and arrangement of the controller.

But not only the larger phases of electrical life are born here. The Westinghouse electric heating apparatus is made in other shops, all part of the main body. This apparatus is of all ranges and sizes and is applicable to all trades and industries. This is a newer field and one of unlimited possibility, giving room to many competent companies today. Yet in the course of time these will be eliminated, as is the way of all business, and the consumption will return to the one or two producers whose goods shall win the favor and reliance of the public.

Educational work among the employes is an important feature of the place as the visitor sees it. Besides the club's educational work, here at East Pittsburgh the technical night school offers at very small expense an opportunity to study the basis of shop work and even of engineering. It is open to all, and enables them to secure both the theory and the

practice of their work, so interwoven that the student learns quickly to apply his studies to his daily shop work. Given these fundamentals of mathematics and engineering, it is possible for the average worker to build his own career along any desired line.

The training may be general and not specific if desired. Besides the general night school work, there are special classes. The apprentice system puts a boy to work for four years and pays him well while he is learning practical electricity. He is not only given the technical training necessary to make him a good workman, but is given a general education as well. The young man who is a graduate of a technical college may enter as an apprentice and in two years, by working in all different parts of the works, become a practical electrical engineer. At present there are about 250 such apprentices at work.

But following out the general Westinghouse idea of striking to the roots of things and achieving something, there are other courses for supposedly finished men. When a college graduate finishes his two year final course here, if he wishes to go on the road he is given a six months specialized sales course. This course gives him an idea of "the latest" in salesmanship and applies his mechanical learning to actual practice.

I mentioned before the remarkable system employed in handling details by these associated companies. In writing this series of articles I came into contact more or less with many publicity men, and looked into their systems of work out of pure curiosity on the subject. It was surprising to me to find that, considering the enormous value to any general manufacturing company of its publicity department, this was very seldom reduced to scientific business methods. In one place the publicity man made no reports, chose his own subjects, and was under no governance whatsoever. In others, the value of publicity was ruined through carelessness and inattention to details. But here the publicity department is as systematized as is any other section of the shops. The total cost of each press notice and article, printed on the place, is known before it is sent out. No—hands off! This article is nothing of the kind!

An extremely interesting building is the print shop. Here are printed the catalogs, circulars and forms for the district sales offices and dealers. Here are the latest type setting machines. I saw every form of press from hand to cylinder. Over in one corner were special presses, getting out certain ruled and punched kinds of paper to be used as graphic meter records. Seven artists are employed on various work in their own lines—illustrating publications. This is one of the busiest little printing houses the visitor will find in a long time; but more than this, it turns out fine work—work that is artistic to the last detail. Here are immense piles of stock, material of all kinds from paper to pencils, intended for distribution among the various offices and branches. It is this great amount of work which justifies the establishment of a private plant like this, for on quick work there is a large saving in time, while the presses can be kept going on forms and letterheads always.

The relief department of the company is noteworthy. Doctor Charles A. Lauffer has achieved a national reputation in the resuscitation of supposedly dead persons, whether the injury is electrical or otherwise. The employes of the company are trained in this work and are rendered thoroughly conversant with Dr. Lauffer's method.

All of this is much more than business. We used to say "Where there's smoke there's fire." But that was before Pittsburgh was. Now we say "Where there's smoke there's achievement." When you go through this plant you realize that great undertakings have made the name of Westinghouse famous; not because they have been attempted, but because they have been *achieved*.

SAVING the FUR SEAL MOTHER

Theodore Roosevelt, in his message to Congress on December 4, 1906, said: "The destruction of the Pribilof Islands fur seals by pelagic sealing still continues. . . . . In case we are compelled to abandon the hope of making arrangements with other governments to put an end to the hideous cruelty now incident to pelagic sealing, it will be a question for your serious consideration how far we shall continue to protect and maintain the seal herd on land with the result of continuing such a practice, and whether it is not better to end the practice by exterminating the herd ourselves in the most humane way possible."

In 1874 Congress directed that the approximate number of fur seals upon the Pribilof Islands be ascertained and the report placed the number at 4,700,000. In August, 1906, the entire herd upon these

islands was less than 180,000 and this together with the reports of the cruelties practiced in pelagic sealing brought forth the prompt and vigorous action at this time of Mr. Roosevelt. And since, up to the present time, the United States has sought to protect from extermination its fur seal fisheries and to this end has tried out any available and feasible means suggested.

It is the female seal that must be kept from harm and however ruthless or hardened or eager the seal hunter may be, his desire for gold is the thing that he seeks to satisfy. Destroy the value of the pelt of the mother and mark her so this may be known and she will be passed by even though her "white-coated pup" is batted over the head and stripped.

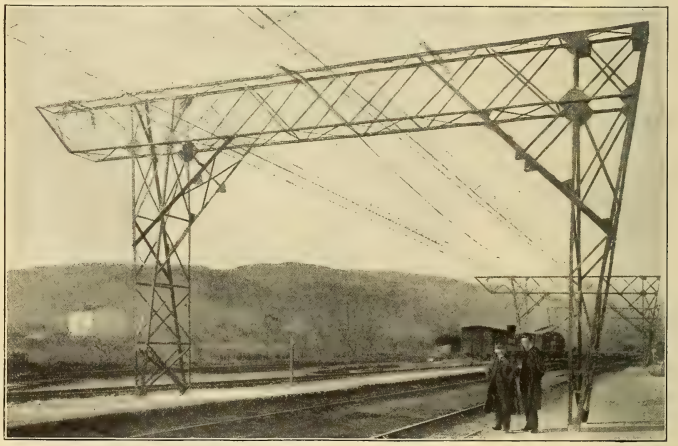
And to put this mark upon the female —the mother—the surgeon's electric cauterizing wire has been used by the United States authorities with success. She is branded—her shining fur and hide is made valueless by the application of a platinum wire heated to whiteness by current supplied by a dynamo driven by a gasoline engine. By moving this wire once over the animal's body, the hair and fur are virtually mowed away. A second sweeping of the wire across the now exposed surface destroys the cells so that no more fur can grow there and the mothers in a herd are readily distinguished.

But how will this affect "pelagic sealing?" The habits of the herds of the Pribilof Islands will answer this. Early in May the bulls of the herd coming from the warm waters farther south along the Pacific coast take their places upon the boulder-strewn beaches and rocky slopes awaiting the arrival of the females who come during the month of June. Here the baby seals are born and fed by the mothers until November when mothers and "pups" (the latter swim at the age of six weeks) start south for the winter. And it is during this winter migration that the mother may owe her life to the mark left by the electric branding wire, for sealing vessels haunt the waters through which the herd goes south. The seals are frequently found sleeping on the

surface of the water. The sealing vessel sights them. Boats are lowered, the hunters put off to the windward of their prey. The spearman stands in the bow of the boat, the shaft is thrown, the animal tired out and then the poor brute is drawn aboard to be ruthlessly killed with a club.

In the water the female cannot be distinguished and the hunter kills every animal found. Branded, the scarred surface is visible. Killing the female seal when going northward in the Spring means also the destruction of her unborn offspring. Killing the female in the months of August and September while still on the islands means the death by starvation of the young seals still under the mother's care. In 1896 alone over 16,000 young seals were found dead from starvation on the Pribilof Islands.

And this is pelagic sealing, against the wholesale barbarity and destructiveness of which the United States is seeking methods and looking to electricity as a possible means.



OVERHEAD CONSTRUCTION IN FRANCE

Those accustomed to the ordinary types of overhead line construction of electric railways in this country, the trolley wire being simply supported by a cross suspension from poles on each side of the track, or even to our so-called catenary construction, but slightly more complex, will gaze with wonder upon this view of some overhead work built by a French interurban railway. The line is known as the Chemins de fer du Midi and the construction is designed after the Vedovelli-Priestley system. The heavy steel towers, the three wires, triangular trolley conductors, suspended from the towers by catenary cables, the intricate bracing in every imaginable way remind one of a half-completed suspension bridge. We might almost suppose that the overhead work would carry the cars themselves, instead of simply supplying a smooth contact for the gracefully designed, sliding trolley bows which they use in that country in place of our ordinary trolley wheel.

Power Crane in Gravel Handling

The ease with which large quantities of sand or gravel may be handled by electric power is demonstrated in the accompanying illustration. The Browning crane runs upon an eight wheel truck with the machinery enclosed in a steel house. The boom is 38 feet long, making it possible to cover an area of sixteen square rods, for the crane is so constructed that it can rotate in a complete circle. Equipped with the grab bucket no labor is required except that of the operator. The lifting capacity of the crane varies from three to fifteen tons, depending upon how far from the truck the weight is located.

POWER CRANE AT WORK

Record-Breaking Reel of Wire

This is an age of record breaking. We have record-breaking buildings, each new one exceeding older ones in height; there are new ocean steamships breaking size and time records and there have been new world's records made in athletic contests.

A record-breaking reel of wire is shown in the accompanying picture. This is the largest reel of duplex armored submarine cable ever turned out at the Hawthorne works of the Western Electric Company. Something of its size and length may be vaguely conveyed by the following facts: It contains 26 pairs of No 13 gauge copper conductor and is only 180 feet short of being a mile long. To manufacture the cable there were required over 1,000 pounds of paper, 15,000 pounds of lead, 47,000 pounds of wire and 7,500 pounds of miscellaneous material. The gross weight of the reel with its blocking was 56 tons.

THE LARGEST REEL OF WIRE EVER SHIPPED

The cable has been laid across the Mississippi River below Vicksburg, for toll line purposes.

For heating various kinds of baths, electricity is invaluable. By means of a portable electric hot air cabinet the luxury of a Turkish bath can be enjoyed readily and cheaply. The sand bath and ordinary water bath are heated by means of coils electrically heated and immersed in water or sand.

Finish for Electric Fixtures

Every one is familiar with the standard finish and color of electric fixtures, but knows little about the process in general of the finishing. Each manufacturer has a certain finish which he gives a name, but the most common finishes in general use are: polished brass, brushed brass, dead black, nickel, mottled and oxidized brass. All finishes are used in residences and small stores, but in large public buildings, dead black, nickel, mottled and oxidized brass give better service. If brushed brass is exposed to dirt as in public buildings, it will soon become dirty and have to be removed and taken to the finishing works to be restored to its natural color.

Polished brass will not hold its color as well as brushed brass. To polish brass is simply to rub it up to the desired degree, then lacquer. The surface is very smooth, while the surface of the brushed brass is rough, thus giving the lacquer a better surface to cling to than the polished brass.

The finish known as dead black is produced by making the surface of the brass rough, then spraying it with black lacquer. The mottled finish is made by first polishing to the desired degree, then rubbing with Scotch stone and water, with a gyrotary motion. The oxidized finish is secured by immersing in a bath of chemicals until the desired color is obtained. The principal chemicals used are nitrate of iron, hyposulphite of soda and water.

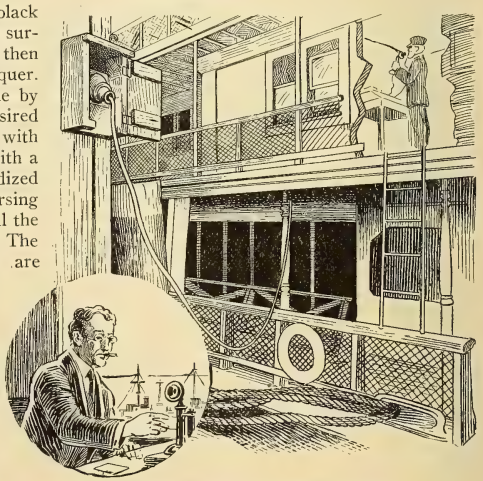
After lacquering, the surface of the fixture is kept from oxidizing. To help the lacquer perform its duty, the fixture is baked, which also improves its appearance.

Other finishes not in general use are antique and rich gilt. The former is a little darker than brushed brass, while the latter takes on the appearance of gold.

Telephone Service to Docked Vessels

Although we cannot as yet telephone between New York and London, the New York Telephone Company has done the next best thing to transatlantic service by equipping a number of steamers with facilities permitting connection to the city telephone system. Both the Cunard Line and the Hudson Navigation Company have this convenience for their passengers, and the illustration shows the manner in which it is used. The wires from the land telephone line terminate in what are known as "jacks" in the weatherproof box on the pier.

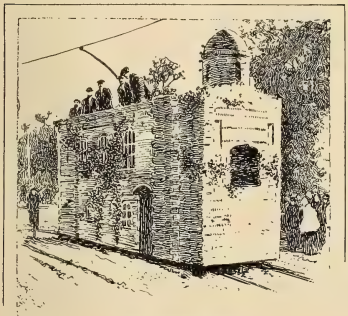
As soon as the steamer is docked a flexible cable connected to jacks on the pier and in the boat is immediately put in place. Business may be transacted and good-bys said up to a moment before the boat leaves.



TELEPHONE IN USE ON A DOCKED VESSEL

A Castle on a Trolley

One of the unusual features in connection with "Shopping week" in Colchester, England, was an electric railway car covered over to represent an old castle. This



THE CASTLE CAR

attracted a great deal of attention as it traversed the various lines of the city, especially at night when it was brilliantly lighted with incandescent lamps.

Freak Ordinance

The Philadelphia Rapid Transit Company recently received a letter proposing that the ordinance printed below should be passed by the Common Council of that city. A copy of the "ordinance" also was sent Mayor Blankenburg, a director of the company ex officio. Some clauses of the joke ordinance follow:

"Section 1. Be it ordained that from and after the date of the passage of this ordinance all the cars of the Philadelphia Rapid Transit Company shall make alternate stops at the near and far sides of all street crossings as shall be further directed in the following sections:

"Section 2. For the time intervening between the odd and even hours all cars shall stop on the near side and from the even to the odd hour cars will stop on the far side.

"Section 3. When the near-side stop is made all male passengers will enter the car by the front entrance and leave by the rear exit. All female passengers will use the rear entrance and the front exit at this time. When the far-side stop is made all passengers will enter the car by the rear entrance and leave by the front exit. All female passengers will use the front entrance and rear exit at this time.

"Section 4. Children will be allowed only at the hour corresponding to their ages. For example, a child of five years may ride from 5 to 6 o'clock, a child of twelve years from 12 to 1 o'clock, and at no other time.

"Section 6. And it is further ordained that nothing in this ordinance or any section thereof shall be so construed as to require or enforce the payment of fare, either in cash, its equivalent, or any substitute therefor, to the Philadelphia Rapid Transit Company by any passenger of either sex or any age if it can possibly be avoided by said passenger, and any act, endeavor or effort on the part of any official, agent, employee or representative of the company to demand, force, coerce, extort, compel, exact, claim, cajole, solicit, entreat, induce, beg, beseech, supplicate, request, petition, require, ask, desire, obtain, take, collect or recieve the payment of fare shall be deemed a violation of this section and ordinance."

Pearl Lightning

Doctor W. J. S. Lockyer has collected some interesting accounts of the phenomenon known as beaded, or pearl, lightning. Several engineers in California not long since saw lightning discharges, which struck the earth, and left beautiful strings of fire beads in their course, that remained visible for perhaps a quarter of a second. "There seemed," the report states, "to be a bead of fire at every angle in the course of the spark." Other observers have noted beads of lightning which remained visible for at least a second.

The Hippodrome and its Electrical Stage Effects

BY ARTHUR VOEGTLIN

In telling of the striking results electricity has permitted me to secure and of the many time and labor saving devices in the mechanical department of the stage which electricity has permitted me to employ, I must first, to make the story quite clear, tell something about the unique nature of that monstrous playhouse in New York which we call the Hippodrome, and particularly about its stage. Such facts serve to illustrate the added importance of electricity to the proper presentation of our productions. Without it they would be impossible.

The Hippodrome is the largest playhouse in the world. In construction, equipment and conduct it is single of its kind. It represents an outlay of $2,350,000. Five thousand two hundred persons find comfortable accommodations in its capacious body.

The proscenium is 98 by 37 feet, while the total width of the stage is 200 feet between walls and it has a depth of about 120 feet from the foot lights. These are amazing figures when compared with other theaters. The proscenium of the average stage is about 35 by 30 feet and the average stage from 25 to 40 feet deep. The back drop curtain of the Hippodrome is 85 feet by 212. The ordinary playhouse curtain is no more than 24 by 35 feet. From these figures it can be readily judged that lighting effects which would be very satisfactory in the ordinary theater would be most unsatisfactory in the Hippodrome.

To produce our electrical results we are obliged to work along entirely original lines. We cannot copy because we would not gain the same results. Every electrical effect must be worked on a gigantic scale. To describe the difference between our electrical equipment and that of other theaters, let us start with the foot lights. We have 600 of these lights of 32 candlepower each. In most theaters there is only a single row of foot lights. Our foot lights are arranged in a double row. Moreover, the average theater has only about 70 foot lights of sixteen candlepower each. Think of the difference. For our border light effects we use 3,800 60 watt tungsten lights, while the average theater only uses about 500 six-

ANNAPOLIS SCENE AT THE HIPPODROME. THE AFTERNOON SUNLIGHT EFFECT IS THE BEST OF ITS KIND EVER SHOWN ON A STAGE

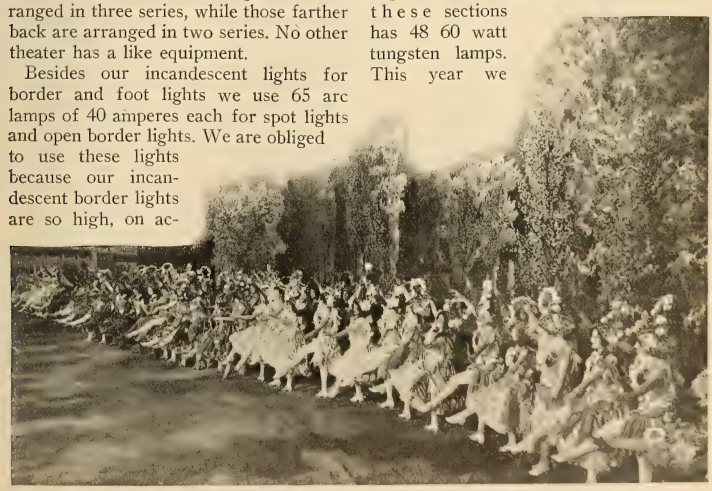
ARTHUR VOEGTLIN, INVENTOR AND DESIGNER OF THE NEW YORK HIPPODROME

teen candlepower lights for the same purpose. Our front border lights are arranged in three series, while those farther back are arranged in two series. No other theater has a like equipment.

Besides our incandescent lights for border and foot lights we use 65 arc lamps of 40 amperes each for spot lights and open border lights. We are obliged to use these lights because our incandescent border lights are so high, on account of the height of the stage, that it is necessary at times to use the more powerful lamps for proper effects. For border lighting, 22 of these lamps are arranged on a bridge which is operated by six men. For full scene effects these lamps are most useful.

On each side of the stage are located what we call our effect lights. These are situated in a gallery 30 feet from the stage. Ten lights altogether are used, five on each side, requiring 40 amperes each. With these lights we produce many marvelous electrical effects, simulating sunshine and shadow, fire effects, water effects and a thousand other electrical effects which amaze the Hippodrome audiences, and even to many expert electricians seem really wonderful.

Besides the results produced by the effect lamps, we depend greatly upon our strip lights for ground effects. These lights are in four colors—red, white, blue and green—and it is marvelous how they light up any small scene. We have four rows of these lights and there are eight separate sections to each row. Each of these sections has 48 60 watt tungsten lamps. This year we



BALLET OF THE FLOWERS. SHOWING MARVELOUS LIGHT AND SHADOW EFFECTS

have been able to operate these strips to better advantage than ever before by hanging them on a battan which, when not in use, is hoisted by electrical power into the flies. By this electrical arrangement we have been able to save the work of fifteen men. These lights are now operated by simply turning a switch when the lights are lowered into the position desired and all that is then necessary is for stage hands to lift them from the battan and connect them with the power which is at hand. Several men can do this work well and rapidly.

Apart from the strip lights we have instituted this year ten front lights requiring 40 amperes each. These lights are situated in the center of the front row of the family circle and are equipped with very powerful reflectors. By the aid of gelatin films we can change the lights to any colors desired. These front lights take the place of the old fashioned calciums, a light which has always been an annoyance and worry to every producer. The visitor to the Hippodrome for the first time is always impressed with our wonderful simulation of sunlight, moonlight, sunset and sunrise. No other stage in the world shows these varied light effects so satisfactorily reproduced. We have been able, by the use of our effect lamps to create a picture, a real atmosphere of the outdoors so perfect that the spectators are instinctively carried to the location we are endeavoring to picture. Of course the size of our stage helps vastly in this effect but after all this would amount to nothing if the proper employment of electrical effects was lacking.

It takes us frequently weeks to work out these results. This work is all practically done in the summer time. After the Hippodrome is closed for the season we begin immediately on our next year's production. The scene is set and then we start to work out the proper light effects for it.

One of the most satisfactory results which electricity has enabled us to arrive at is the instantaneous "black-out." The present production at the Hippodrome, entitled "Under Many Flags," is shown in three acts, but between these acts there are a number of scenes which are in reality separate acts, requiring an entire change of most elaborate stage settings.

In many theaters it would still be necessary to lower the curtain to change for these scenes, but by the use of the instantaneous black-out we only lower the curtain twice during the entire performance and this is only done because we desire to break the show and give the audience slight intermissions to think about it. We could readily produce the show from beginning to end without raising or lowering the curtain. Some day we may.

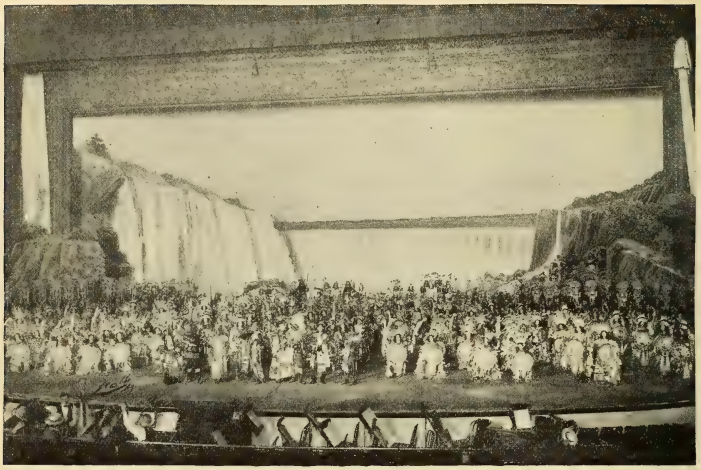
The stage manager of a few years ago would have found this impossible in the proper presentation of a performance of the magnitude of that which we are now presenting at the Hippodrome. It has taken us a long time properly to work out this instantaneous black-out, but now it is so perfect in operation that the spectators, even in the first row of the orchestra, are unable to see one thing that is going on upon the stage, which of course adds greatly to the height of the effect when the lights are again instantaneously switched on.

All our electrical effects are dependent upon the proper manipulation of our switchboard. This is situated in a gallery to the right of the stage. It is arranged on the A. B. C. system of four colors of red, white, blue and green and is regulated by 160 dimmers. Three men, every one an expert in stage lighting, operate this switchboard. Each dimmer has sixteen different steps. Thus we are enabled to get any shade of light we desire. Besides the dimmers there is a main gang switch which instantly throws every light on the stage on or off. This is used for the instantaneous black-out.

In connection with the switchboard we have this year introduced a real novelty, a loud talking telephone; in other words, a telephone with what might be described

A SCENE ON THE COAST OF BRITTANY

THE ELECTRIC LIGHTING OF THE BACK DROPS IS SO REALISTIC THAT THE AUDIENCE IS TRANSPORTED IN THOUGHT TO THE HIGHLANDS



NIAGARA FALLS AS PICTURED A FEW YEARS AGO AT THE HIPPODROME. THE FALLS WERE NOTHING BUT PAINTED CANVAS, BUT SO INGENIOUSLY LIGHTED THAT THE EFFECT OF A TREMENDOUS VOLUME OF FALLING WATER WAS SUCCESSFULLY IMITATED

as a megaphone horn. The voice from this can be heard for 30 feet. Thus, if as the producer, I do not think that the lighting of any scene is just right, all I have to do is to step to a telephone to the rear of the auditorium and quietly tell the men at the switchboard where they are in error. They can hear what I have to say without having to interrupt their work to go to the telephone, and can quickly correct the defects. This loud talking telephone is an invention of our own, but I look for its introduction in many theaters before long, as it is a wonderful time saver.

For our alternating current we have a separate switchboard. This alternating current we use for water effects, the lighting of diminutive scenes, etc. Another electrical device which we have at the Hippodrome and which is not to be found at any other theater in the world, is shown in two hoisting machines, located one on each side of the stage. One is operated by a five and one by a three horsepower motor. These hoisting machines are most valuable for lifting heavy scenery, also big drops and anything that hangs. Any other theater has to have stage hands and fly men to do this burdensome lifting. By their use we save the work of at least 12 men, as it is only necessary to have two men to operate them. Besides, we save a vast amount of time in stage setting which is important in preventing our black-out from becoming tiresome to the audience. Now they wonder how we accomplish these changes so quickly. The answer is by electricity.

Running around the stage to the rear is an electric crane. By the use of this crane any kind of heavy machinery can be shifted from one part of the stage to another and it saves the work of from six to eight men. It is also useful in some of our stage effects. For instance, this year an airship we use in our piece floats gracefully across the stage along one of the tracks of this electrical crane.

Practically all our lifting on the stage

is done by electrical power. We have a number of different power motors. A 50 horsepower motor raises and lowers the stage and the water tank, the asbestos curtain and strip lights. Heavy pieces of scenery are also moved off the stage by motor power. In the tornado scene in this year's production, most of the scenery is removed in this way and the effect of buildings falling down and being blown away is most realistic.

At the Hippodrome we have an immense grass mat which covers the stage and weighs three tons. Before we employed electrical power to move our stage properties, it used to take 65 men to bring this mat up from under the stage, while now it is done by an electrical hoist run by one man, the power being furnished by a five horsepower motor.

One of the best and most startling electric light effects produced in our present show occurs at the end of the first scene which pictures the lawn of the White House. After the stage has been lit with brilliant sunlight, darkness gradually sets in until finally a very beautiful sunset effect is produced with the charming light of the afterglow. Then gradually the light fades until darkness sets in. Then at the proper moment the instantaneous black-out is used and the stage is shrouded in utter darkness. In an incredibly short time the stage is reset and the lights again go up instantaneously on our second scene, the parade grounds of the naval academy at Annapolis. In this scene the stage is flooded with a glorious volume of mid-afternoon sunlight. It took us a long time to work out this exceedingly contrasty light effect, but that the audience appreciates it is illustrated by the applause which the lighting of the Annapolis scene always brings forth.

Another very startling electrical effect is produced during the tornado. It occurs in scene ten, part two. Following the tornado comes a prairie fire. This fire is most realistic but it is entirely produced by the combination of our electric lighting, yet the audience sees the flames leaping up and flickering in the wind just as they would when a real fire occurs during a heavy wind storm.

Weed Burners on Electric Railways

The work of hundreds of Mexican laborers on the tracks of the Pacific Electric Railroad in California is now being done by a weed burning device that eliminates the hard work with mattocks and hoes. This extensive trolley system which

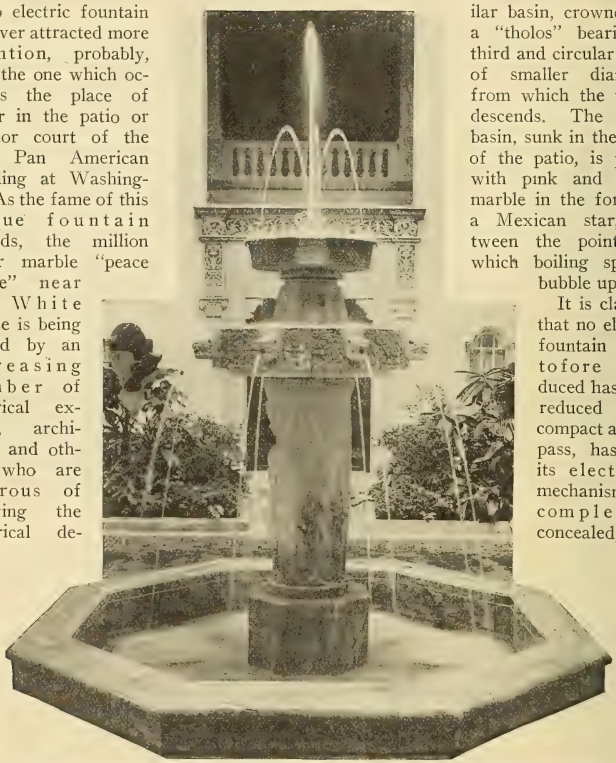
WEED BURNER AT WORK

centers in Los Angeles has hundreds of miles of track which must be kept free of weeds and the new invention is attached to an electric locomotive, and, together with an oil tank and water car, is hauled over the line at the rate of about ten miles an hour. Green weeds and dry are destroyed alike by this device, and the cost is but a fraction of the former expense, only about 80 cents for a mile strip about 20 feet wide.

The invention is the work of E. E. Allen, a Los Angeles inventor, who has experimented for years with weed burning devices using crude oil as the fuel. The crude oil is brought into contact with live steam by this system, forming a gas emitted under the car and ignited, burning the weeds to the roots and destroying all seeds that are cast on the right of way. The heat is so intense that the bottom of the car and the extended side wings are covered with metal, which in turn is protected by a coating of cement.

FOUNTAIN OF THE "PEACE PALACE" AT WASHINGTON

No electric fountain has ever attracted more attention, probably, than the one which occupies the place of honor in the patio or interior court of the new Pan American Building at Washington. As the fame of this unique fountain spreads, the million dollar marble "peace palace" near the White House is being visited by an increasing number of electrical experts, architects, and others who are desirous of studying the electrical details of the fountain in order to embody some of the ideas in fountains to be placed in public buildings and in private mansions.



ARTISTIC ELECTRIC FOUNTAIN DESIGNED BY MRS. HARRY PAYNE WHITNEY FOR THE PAN AMERICAN UNION

This marble fountain at the home donated by Andrew Carnegie to the Pan American Union was modeled and executed by Mrs. Harry Payne Whitney, nee Gertrude Vanderbilt, and consists of a pillar rising from the midst of an octagonal basin and supporting a smaller similar basin, crowned by a "tholos" bearing a third and circular basin of smaller diameter from which the water descends. The lower basin, sunk in the floor of the patio, is paved with pink and white marble in the form of a Mexican star, between the points of which boiling springs bubble up.

It is claimed that no electric fountain heretofore produced has been reduced to so compact a compass, has had its electrical mechanism so completely concealed, nor has had this mechanism so ingeniously combined with the sculpture.

Electricity is employed for the illumination of the basins of the fountain and to give glow to the jeweled eyes in the feathered serpents' heads that surround one of the basins, but the main utilization of the magic current is for illuminating in changing colors the streams and sprays that ascend in varying form and volume from the upper basin. The

fountain is capable of producing twelve different water combinations or shapes and for illuminating these there are available sixteen colors and tints. Both the colors and the changes of water are controlled at a specially constructed switchboard, which is in the form of a keyboard desk.

The main utilization of the fountain is on ceremonial occasions, and at such times its electrical illuminating facilities are employed to produce successively the national colors of the 21 republics of the three Americas. These color effects are produced to the accompaniment of the rendition of the national anthems of the various republics by the United States Marine Band, stationed in the patio, and the musical director and the chief electrician have so perfected their co-operative work (electric signal buttons insuring accurate unity of action) that they are now enabled to produce the 21 distinctive color combinations, each with its appropriate incidental music, in a total elapsed interval of seventeen minutes.

BESMIRCHING THE SKIES

Had our great American novelist, W. D. Howells, seen the above illustration in time, he might have added another interesting page to his fascinating "Letters from Altruria." Well might his visitor from Mars have asked: "What are you doing? Are you blackening the the skies and obscuring the daylight in order that you may pay for more artificial light?" Of course the native American (or European, for that matter) would indignantly have denied that this was the case, and yet there would have been the usual implied germ of truth which makes Howell's report of the Altrurian's questionings such delightful reading.

The fact is that in the earlier decades of our modern industrial development we so accustomed ourselves to smoke belching from the stacks of our factories that we have grown not only to tolerate the nuisance but even to pride ourselves on it. So when our impressionists wish to depict a group of typical manufacturing plants, they top them off with the soot and smoke supposedly emitted from their chimneys. To them, smoke is still an index of industry—which goes to show how sadly artists usually lag behind the progress of their time.

But the progressive man or woman knows that a smoking chimney is a sign of either imperfection or undevelopment; that rapid transit is now typified not by the soot-hurling steam locomotive but by its cleanly electric successor, and that the modernizing of electric power distribution has involved a minimizing of smoke. Like the puffing and snorting of the old types of engines the belching of smoke is only a survival of methods which are fast becoming obsolete. The smokeless factory with the almost inaudible purring of its electric motors may not lend itself so readily to the artistic conceptions of those unfamiliar with the real progress of our times, but it represents the industrial status of the more enlightened sections and our artist friends must learn to acknowledge it as doing so.

Curious Fact as to Lightning

It is a curious fact that, sitting in a dark room at night, an electrical storm coming on, the observer of electrical phenomena will be unable to determine from which of the points of the compass a blinding flash of lightning proceeds, even though the room in which he sits possess four windows to the four points of the compass. This statement applies, of course, in the event that the window shades be lowered sufficiently, that the possible bolt may escape the eye. The roll of thunder will be the first intimation the observer has of the storm direction.

This fact is especially noticeable when the rain has begun to fall heavily, and when the raindrops have, in a sense, become reflectors of the light, giving the effect of sheet lightning. At such a time, when the skies seem sheets of flame, one may observe how this reflected light penetrates to every corner of a room with a brilliancy not outdone by sunlight.

Sunlight, coming in direct rays into a room, leaves its shadow spots; the reflected light of the lightning stroke leaves the ceiling and the floor equally illuminated.

A Paint Train

The electrification of portions of some of the steam railroads of the country has brought up some unique problems in connection with the maintenance and painting of the large amount of overhead structure necessary to carry all the overhead trolley wires. The New York, New Haven and Hartford Railroad has solved this problem in a very simple manner by building paint trains with cars built with platforms which can be raised or lowered by means of winches. The train is run under a section of superstructure needing painting and the men are hoisted right up to the overhead wires and bridges.

A paint train ordinarily consists of five bridge cars, a paint car and an engine. The crew consists of 32 painters.

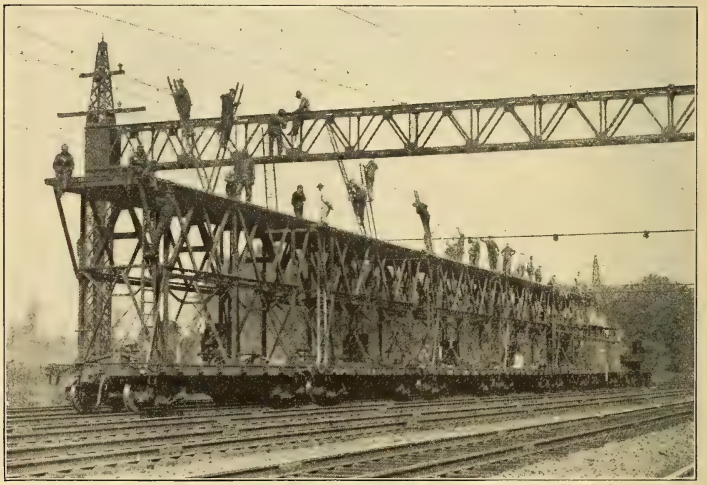


Photo by Brown & Dawson

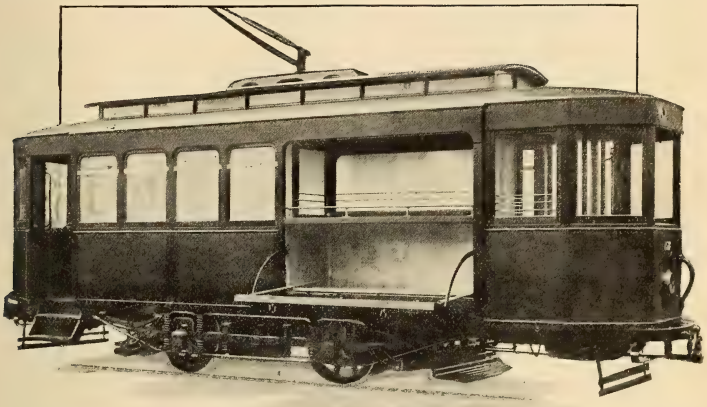
A PAINT TRAIN ON THE ELECTRIFIED PORTION OF THE NEW YORK, NEW HAVEN & HARTFORD RAILROAD

A Funeral Car in France

The Compagnie des Chemins de fer Nogentais, an electric railway company operating near Paris, has placed in operation a special funeral car for use between Vincennes and the Nouveau cemetery.

The funeral car has several compartments for the use of the bearers, the funeral director and mourners, the casket being placed in a compartment near the front. Additional cars are also provided in the funeral train each carrying 50 to 60 persons.

To facilitate the removal of the casket, one of the side panels of the car drops down and outward to form a platform on which the casket may be easily rolled out.



A FUNERAL CAR ON AN ELECTRIC INTERURBAN RAILWAY NEAR PARIS

Nursery Noise Indicator

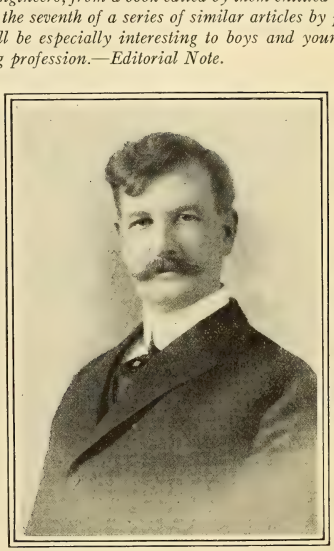
Are the children all sleeping soundly? Every night brings that same question to untold thousands of homes in which mothers are glad to have their little ones in a children's room, yet half worried at not having them close by. In such cases, what is the anxious mother to do? Must she keep the hall doors open both from her chamber and from the nursery, thereby allowing all the noises of the house to disturb the occupants of both rooms? Or shall she tiptoe occasionally to the children's room to see if all is quiet there? In either case, the mother's sleep would be considerably broken.

Here again, an electrician has come to the rescue with a simple solution which ought to bring added comfort to thousands of homes. He places a telephone transmitter with its battery on a shelf in the nursery, high enough to be well out of reach of the children, and runs wires from it to a receiver hung beside the mother's bed. During the day, a switch at the receiver cuts off the telephone circuit so that no sounds will be carried by it from the nursery. But at night, the switch is turned on and the mother can at once settle down to a sound sleep, knowing that if a child should cough or become restless, she would immediately hear it, even though the hall doors to the various rooms are tightly closed.

The Value of English to the Technical Man

BY JOHN LYLE HARRINGTON, CONSULTING ENGINEER

Extracts from address delivered in 1907 by Mr. Harrington to the Technological Society of Kansas City, the Engineering Society of the University of Missouri and the Civil Engineering Society of the University of Kansas, and published through the courtesy of Waddell and Harrington, consulting engineers, from a book edited by them entitled "Addresses to Engineering Students." This is the seventh of a series of similar articles by prominent educators and business men, which will be especially interesting to boys and young men who contemplate following the engineering profession.—Editorial Note.



You will recall Sam Weller's remark regarding Mr. Nupkins' eloquence that "his ideas come out so fast they knock each other's heads off and you can't tell what he is driving at." Like any other instrument, the value of language is in direct proportion to our knowledge of it and our skill in its use. If we understand it fully and use it skillfully, it will serve our purpose well, but if we are novices and bunglers only disappointment will result.

Language, though it will not supply the place of thought, is a most essential instrument to every man. To him who is without important thought to express, it is not a very valuable tool. The laborer does not require it in handling the pick and shovel; it is only in his social relations that he has much need for speech. It is not important that the stoker speak fluently, or that the mechanic be an able orator or writer. But as we proceed from the lower to the higher and more intellectual occupations, the need and the value of knowledge and command of language will be found to increase rapidly.

The technical man; that is, the engineer, the architect, and the applied scientist of every kind, finds a sound, accurate knowledge of the language essential to him in every part of his work. A wide and precise knowledge of words is required in his reading as well as in his general writing; in his business and professional conversations even more than in those of a social nature. But, in the preparation and interpretation of technical correspondence, specifications, and contracts, the use of perfect language reaches the highest degree of importance.

You may say that it is absurd to state that men who have graduated from any college cannot spell correctly, but many of them cannot. S-e-d, said, p-e-a-r, pier are extreme, but true examples. It is very common to find misspelled words in letters written by young engineers. They consider such errors of no material consequence, because they are not technical errors. The mind has been so fixed upon the scientific work during the course of study and while the early experience is being acquired, that such matters as lan-

guage and culture seem to be of little importance. But the recipient of the letter generally takes a different view of the matter, for he justly considers the writer something of an ignoramus.

There are technically educated men who say "I have saw," "I seen," and "I done;" and there are men in high places who require no further proof of the speaker's deep ignorance, not only of English but of technical matters as well. One who is thus ignorant of the language finds social progress substantially impossible. This may seem a trivial matter and foreign to our purpose, but it is not. Matters of very large importance are often settled by favor, and favor frequently follows social position. Other things being equal, almost any one will show his friend the preference in business or professional matters. It is even common to stretch a point in favor of a friend.

Language has large weight in classifying a man, infinitely more than manner or dress. It exhibits his breeding and indicates his social status. I do not mean that it shows whether he belongs to the so-called "smart set," but whether he is of the educated, cultured class, whether you would care to entertain him at all, and, if so, whether you would send him to your less or more select club, or whether you may extend the extreme courtesy of inviting him to your home. This may appear at first glance to be of small consequence, but great things often result from associations quickly formed.

There are many vocations in which it is not essential that a man be cultured and intelligent; but the technical professions are not among them. Nothing so surely marks a man's secret habits of thought, his real character, as the little tricks of speech which are exhibited when his mind is upon the matter rather than the manner of his speech. If his thought be habitually coarse, crude, or brutal, his speech will make the fact manifest at times; and the speech of a moment frequently produces a permanent and vital effect.

But the preparation of reports, specifications and contracts is the most particular and momentous task the technical man has to perform. A misused word, a phrase whose meaning is ambiguous, a paragraph that is confused, or the omission of a direction or a precaution, may result in great damage to both the client and the technical man. It is not enough to be careful in a general way. Every word, every phrase, every sentence has a direct bearing on the work governed by the documents. I have known the presence in a contract of a single word of equivocal meaning to cost one of the parties many thousands of dollars, though when the contract was drawn there was no question regarding the intent of the parties to it. Probably the majority of the civil law suits are caused not by trickery or deceit or dishonesty, but by the use of ambiguous words and phrases, bad ordering of the matter, incompleteness, and other faults in the language of the correspondence, specifications, and contracts. There is no more certain way for the engineer to protect his own and his client's interests than to prepare all documents in accordance with the best English usage as well as with technical skill; and there is no surer way to lay the foundation for trouble and financial loss than to neglect the character of his language.

Very few railway specifications for complicated structures are so well written that a contractor cannot comply with them to the letter, yet give the company construction far inferior to what the writer of the specifications intended, and thereby gain for himself material advantage.

The lawyers and the courts are kept busy rectifying the blunders of other professional men who do ill what they are paid to do well. I know of one contractor who has grown gray in the business of constructing buildings, who has never completed a contract without a lawsuit, and who has never lost a lawsuit. This speaks ill for the work of the architects under whom he worked, yet they

are probably no worse than their fellows. If it were not good policy to be reasonably honest, many another contractor might easily approach his record.

A thorough study of one or two good books which treat each phase of the study of English, the reading of literature of the best classes, and reasonable watchfulness over one's every-day writing and conversation will inevitably result in habitually correct use of the English language.

Collapse of a Steel Transmission Tower

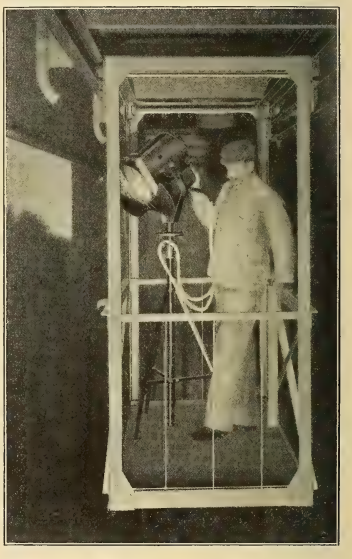
An unusually severe wind storm was responsible for the destruction of a number of steel power line towers on a line being constructed in Southern California.

THE STEEL TRANSMISSION TOWER HUNG LIKE AN OVER-WEIGHTED SAPLING

By a strange freak one of the towers was bent and twisted in the middle and the top hung over half way to the ground like an over-weighted sapling. A number of line men climbed on the steel frame work to have their pictures taken with the wreck, and also to show the comparative size of the pole.

Traveling Spot Light in a German Theatre

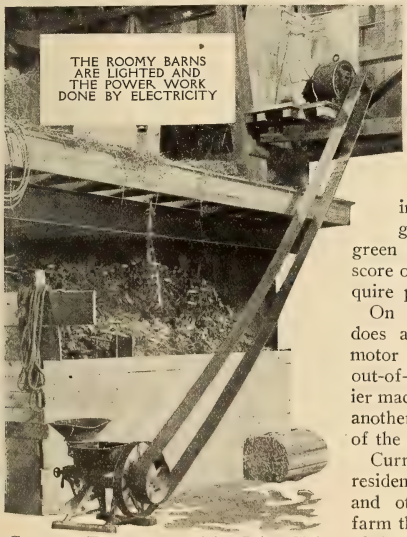
At the New Court Theater in Stuttgart, Germany, extensive use of flaming



SPOT LIGHT OPERATED FAR ABOVE THE STAGE

arc lamps is made above the stage, which make possible particularly artistic lighting effects. Below the first machinery, gallery rails have been mounted from which traveling carriages have been suspended, each carrying a flaming arc spot light and its operator. The movement of these carriages backward and forward enables the stage to be flooded with light at any point without difficulty and without encumbering the gallery with spot light apparatus.

ELECTRICITY AT CRESCENT FARMS



THE ROOMY BARNS ARE LIGHTED AND THE POWER WORK DONE BY ELECTRICITY

Crescent Farms, owned by John Clelland of Scranton, Pa., are located at Mt. Cobb, near Scranton, and are devoted to the raising of fine stock, principally. Great roomy barns are built to house the stock and these are lighted electrically.

Practical farmers know well the amount of work connected with even the item of preparing the rations for animals, particularly when this is done in a scientific manner. Aside from the threshing, the corn and feed must be ground, roots and straw cut up, green feed prepared for the silo and a score of other things necessary which require power.

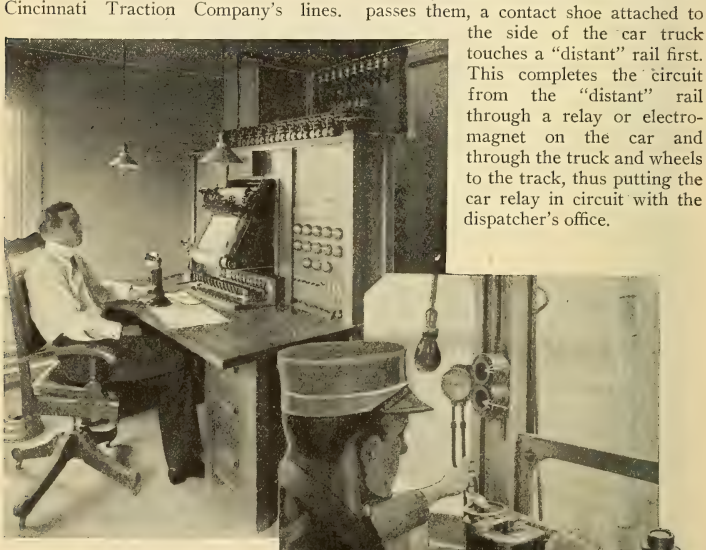
On Mr. Clelland's farm electricity does all this work, one Westinghouse motor of five horsepower, located in an out-of-the-way corner, running the heavier machinery and doing the pumping, and another of two horsepower taking care of the dairy apparatus.

Current is also used in the owner's residence for washing, ironing, sewing and other household duties. On the farm there are about 100 tungsten lamps of the wire type. These are in the barn, the greenhouse, the hennery, the three houses of the help and the large residence of the owner.

All the electrical apparatus was installed about three years ago; a farm boy has been able to give it all the attention it has needed.

Signaling Between Dispatcher and Motorman

A new electrical signal system by means of which the dispatcher is in communication with the motorman in his cab is in operation upon the Indianapolis and Cincinnati Traction Company's lines. With the Simmen system, running orders go directly to the motorman and not to him through intermediate persons.



THE TRAIN DISPATCHER HAS CONTROL OF THE "STOP" AND "CLEAR" SIGNALS IN THE MOTORMAN'S CAB

At each siding along the line are placed three sections of contact rail. Each piece is 72 feet long and resembles a third rail when in position. One length of rail is placed beside the track opposite the siding switch and the other two rails are placed 2,000 feet distant in opposite directions from the siding. The rail at the siding is called the "home" rail, the other two are termed "distant" rails. These three third rails are connected by a single wire along a pole line direct to the dispatcher's office. When a car passes them, a contact shoe attached to the side of the car truck touches a "distant" rail first. This completes the circuit from the "distant" rail through a relay or electro-magnet on the car and through the truck and wheels to the track, thus putting the car relay in circuit with the dispatcher's office.

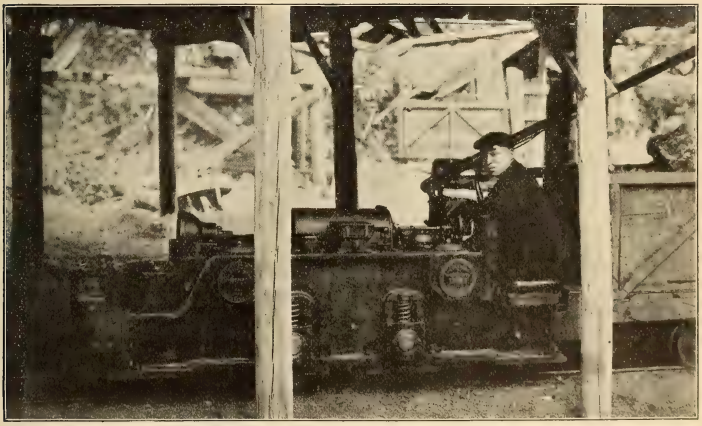
The car relay controls a red and a green light in front of the motorman, indicated by the arrows in the picture, and also a bell. The current for these is furnished by a battery on the car. In front of the dispatcher are switches corresponding to each siding. When a car reaches a rail 2,000 feet from the siding the dispatcher throws the current on or off this third rail circuit which energizes or disenergizes the car relay and lights the proper lamp for "stop" or

"clear," at the same time ringing the bell in the cab. Another feature of the system is the train record sheet which is constantly made in the dispatcher's office. This sheet is a roll of paper moved by clockwork and divided up into time divisions and "blocks." When a train enters a block, needles are actuated that punch the sheet so that the running time of the train is recorded and also the time of entering and leaving the block.

American Equipment in Japanese Mines

Japan's progress in the last 25 years has been along industrial lines as well as in warfare. The Japanese have been quick to see the advantages of making use of electricity in all cases where it is applicable, and the United States has received a large quantity of orders for electrical apparatus and equipment.

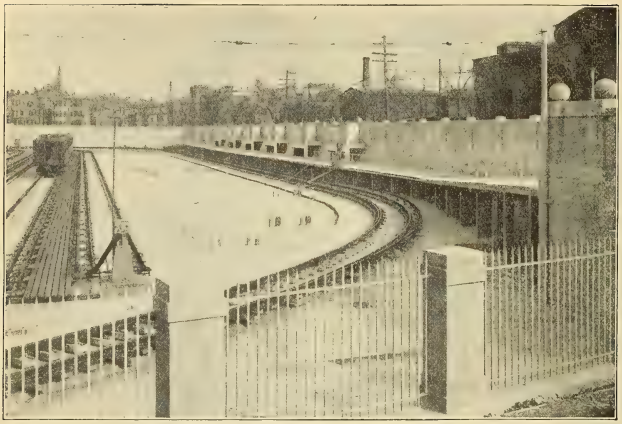
The cut shows a very modern American made electric mine locomotive emerging with a train of coal from the Sorachi Mine of the Hakkaido Tanko Company, located in northern Japan. All employes of the mine are Japanese and the entire electrical equipment is operated by them with great success.



MINE LOCOMOTIVE AND ITS JAPANESE OPERATOR

Edison's Principles Still Followed

Mr. Edison, in conceiving his system of incandescent lighting, started out with certain broad fundamental ideas. He started out with the idea of not merely inventing this or that piece of apparatus but a complete operating system commercially as well as technically. His idea was that in contradistinction to the system then existing for arc lamps, which was known as the series system, with the lamps strung like pearls on a string, and depending therefore on the integrity of that string, each lamp should be operated by itself, capable of operation and extinction, and that all the units of the system, beginning with the engine, the boiler, the dynamos—every part of the system—should be laid out on the same broad comprehensive plan. These fundamentals laid the foundation for the success of the parallel system of distribution as we now have it, 30 years later.



THE HARVARD STADIUM STATION

A new station of the Boston-Cambridge subway system has just been put into use for passengers bound to and from football games and other events at the Harvard Stadium. Until this station was completed people attending the football games at the Stadium, sometimes 35,000 to 40,000, were obliged to "hoof it" to the Harvard Square terminus of the Cambridge subway or take surface cars by a roundabout route. The Stadium station is designed to handle an enormous traffic in a very few moments. There are seven entrances with ticket booths, and three or four trains can be loaded at once from the concrete platform.

The Evaporation of Metals

The evaporation of metals is conducted upon a large scale only close to the surface of the sun, where the hardest metals exist only as clouds of glowing vapor. On a very small scale, however, metals can be evaporated in a beautiful manner. A current of electricity passing between electrodes, through a vacuum tube, supplies the means.

If a piece of platinum is used for the negative electrical pole, the passage of the current drives off some of the molecules of the platinum, which afterward condense on the inside of the glass tube, forming a mirror like deposit.

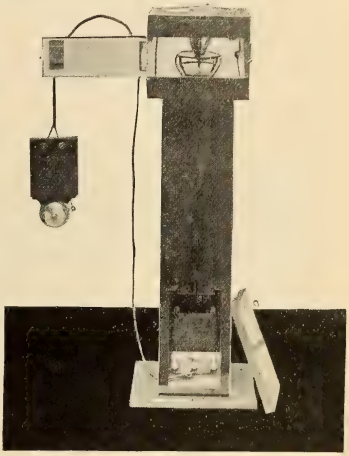
The manner in which this action takes place is most interesting. To understand it, the layman must recollect that the change of any substance from the solid to the liquid, and from the liquid to the vaporous condition, is accomplished by imparting greater and greater velocity to the molecules of which it is composed. If the molecules of a liquid fly too far they will get beyond the molecular attraction of the liquid mass and escape into the atmosphere, or the free space around them, in which case they are said to have evaporated.

The ordinary way in which to increase the motion of molecules, or, in other words, to produce evaporation, such as changing water into steam or vapor, is by the application of heat. Heat is simply a form of molecular motion. But the electric current, streaming from one metal pole to the other, also affects the molecules of which the pole is composed, and by stimulating their motion, drives them beyond the sphere of attraction of the metal, whereupon they fly off until they come into contact with the surrounding glass.

In this way have been evaporated various metals, including that very hard substance, iridium, of which the points of gold pens are made. Gold and silver are very easily evaporated in this manner, while aluminum can hardly be evaporated.

An Electrical Steering Sentry

A novel English electrical steering sentry of the Heath type is constructed at the Hezzanith observatory works at Crayford, England. This instrument automatically gives warning to the officer on watch and in the captain's cabin when the vessel deviates from the course



INSTRUMENT WHICH AUTOMATICALLY GIVES WARNING TO THE OFFICER ON WATCH

set. The amount of deviation from the course before the warning is given may be regulated from 2° to 30° as desired. When the vessel is just off her course and the limit set, the warning bell rings intermittently, but should she deviate considerably from the course the bell rings incessantly.

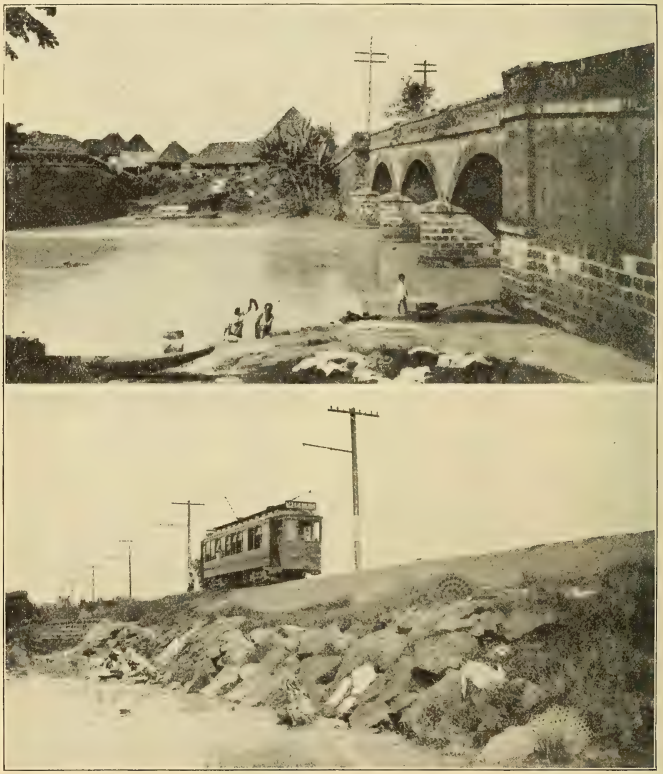
The officer on watch has very often other duties to attend to besides that of checking the steering, all of which take a certain amount of time, during which time the man at the wheel is solely responsible for the steering and has to be trusted.

With the electric sentry in use the officer is at all times aware whether or not the course is being made.

Electric Washing Machines Needed in the Philippines

BY T. JEFFERSON FOX

Since American occupation of the Philippine Islands, now about fourteen years, considerable progress has been made in almost every direction by the Filipinos in employing modern methods in their various callings, but the primitive and very crude manner of washing clothes which has obtained in the islands for the



LAVANDERAS OF THE PHILIPPINES WASHING CLOTHES BY PRIMITIVE METHODS UNDER THE VERY WHEELS OF THE MODERN TROLLEY CAR

past 250 years or more still prevails today. The writer has been in the islands since 1899 and has never seen any one here using a washing machine.

With the exception of a few Chinese laundrymen, who are to be found in almost every country, and two steam laundries, one of which is Government owned and operated, in Manila, a city of 250,000 inhabitants, all laundering is done by Filipino "lavanderas" and "lavanderos," the former being women and the latter men, and about as many of the men follow this pursuit for a living as women. Usually the entire family assist in washing, and it is all done, with the exceptions made above, as shown in the illustration, on the banks of rivers and small streams. The small boy in the upper picture has just brought the garment over his head with all his might against the rock, and it shows the woman in the act of beating the garment against the rock. They wet and soap the clothes (using soap locally manufactured by Chinamen), placing the garments, one at a time, on a rock. Then they take a large club or stick, when available, and beat the garments, and when they have no stick or club they simply take the garments in their hands and beat them with all their might against the rocks until they are in a fair condition of cleanliness.

They use the club more frequently in beating the clothes, which process is extremely hard on the garments; in fact, after a few washings they are unfit for further service and the local tailor is resorted to for a new outfit. Most all the men in the islands wear either white or khaki, averaging about $3.00 per suit consisting of coat and trousers and they do not mind the wear and tear in laundering so much, as they have grown accustomed to it, but it is very different with women's wearing apparel, such as lingeries, laces and linens, etc., and the "lavanderas" are continually reprimanded for the rough usage the garments receive. The native then assures the owner that it will not be done any more, but it is always repeated until there is nothing left of the garments to wash, the "lavandera," by way of consolation, saying, *"patiencia, Señora, no tengo culpa,"* which means in English, "patience, Madam, I am not to blame."

While it is not practicable to use electric washing machines altogether in the islands, still there are about 12,000 European families in Manila, Cebu and Iloilo that could use the electric machine, as current is available in those cities. Electric plants will also soon be established in many other towns in the islands, some now in the course of construction, the population ranging from 20,000 to 60,000 in each, and containing from 1,000 to 3,000 Europeans.

It is readily believed, however, that in a very short time many of the Filipinos, especially those within the city limits where electric current is available, could be induced to adopt the electric machine and ironer if only some live and energetic party would take the trouble properly to demonstrate the merits of these useful and much needed articles to them.

First School for Telephone Operators

In 1902 the New York Telephone Company started a school, the first of its kind in the world, for the education of telephone girls. This school is hidden amid ranges of skyscrapers, but 17,000 girls discovered it in the course of the year. It is a most particular and exclusive school. It accepts fewer than 2,000 of these girls, and rejects over 15,000. Not more than one girl in eight can measure up to its standard; and it cheerfully refuses as many students in a year as would make three Yales or Harvards.

The school is unique, too, in the fact that it charges no fees, pays every student five dollars a week, and then provides her with a job when she graduates. But it demands that every girl shall be in good health, quick-handed, clear-voiced, and with a certain poise and alertness of manner. — *History of the Telephone.*

The Hot Air Douche

The electric hot air douche, consisting of a motor, fan and heater combined, has many uses to which the thoughtful person may apply it, and the fact that it is so light that it can be manipulated with one hand adds to its convenience.

The accompanying illustration suggests its serviceability for drying the hair, warming garments or bath towels, drying gloves after they have been washed, drying Fido's coat after the bath, taking the soreness out of a rheumatic arm, treating the face, warming the bed, and recurling ostrich feathers; and the practical person will multiply the uses enumerated above.

Mouse Ties Up Street Car System

Of all the vagaries of the electric current one of the most curious is reported by the *Portland Carman*. Early one morning the system of the Portland Railway Light and Power Company experienced a bad shutdown. Electricians with expert knowledge were called in to analyze the situation but apparently of no avail.

Finally the trouble was traced to Knott sub-station. Here Operator Abbott was unable to find the cause except that an oil switch was on fire. By cutting the switch entirely clear from the rest of the system, the service was resumed in about ten minutes.

During the shutdown all of the arc circuits feeding out of the Jefferson and Knott sub-stations were dead, and railway service running out of Alder substation in the very heart of the city was at a standstill. After much trouble and spending a great deal of time in trying to solve the problem, it was found that an inquisitive mouse had crawled onto an oil switch at the Knott station and thus formed an electric connection between an 11,000 volt terminal and the concrete work, permitting the high voltage to jump to the ground.

The mouse when found had only his forelegs burned off. The current which

passed through his body should have shriveled him up into a speck of dust. In some manner he must have escaped the withering effects of electrocution, but just the same he made it up in trouble for the electricians and patrons of the company.

The Conductor's Transformation

Uniforms are distasteful to the majority of men who have to wear them during working hours. A conductor on an interurban line has found a way by which he can wear what to the ordinary observer is the usual uniform of the company. At the end of the run he removes

THE CONDUCTOR'S TRANSFORMATION

his brass buttons, which are merely hollow brass covers with slots cut in their backs so that they easily slip on and over the usual buttons on men's clothes. He then replaces his cap with a hat of the latest style and is transformed into a prosperous looking business man in a broadcloth navy blue suit, as per the artist's conception shown above.

Electrical Resistances at Very Low Temperatures

It is well known that with the materials commonly used for electrical conductors, the resistance varies with the temperature of the conductor, and as the temperature rises the resistance also increases, though not always in the same proportion. It may, however, not be so well known that there is a theory among scientific men that if we could reach the absolute zero of temperature (—273° C.), then the resistance of a conductor would disappear entirely. This consideration may be purely theoretical, but it is none the less interesting in view of the fact that the Dutch scientist, M. H. Kamerlingh Onnes, who in 1908 succeeded in liquifying the rare gas helium at a temperature of 4.6° above the absolute zero, has been making experiments on the electrical resistance of mercury at these low temperatures.

In a communication recently made to the Dutch Academy of Sciences, Onnes states that by allowing helium to boil in a partial vacuum measured by a height of one centimeter of mercury, which is equal to the one seventy-sixth part of an atmosphere or about one-fifth of a pound per square inch, he has been able to reach a temperature only 3° C. above the absolute zero. At this temperature he made the surprising discovery that the electrical resistance of mercury is only the one ten-millionth part of its resistance at 0° C.

The possibilities opened up by this discovery are of course tremendous. For instance, if a coil of very fine wire in which the electrical resistance was very greatly reduced by lowering its temperature, should be charged with a powerful current, it would be possible to create a magnetic field of an intensity greater than any hitherto dreamed of.

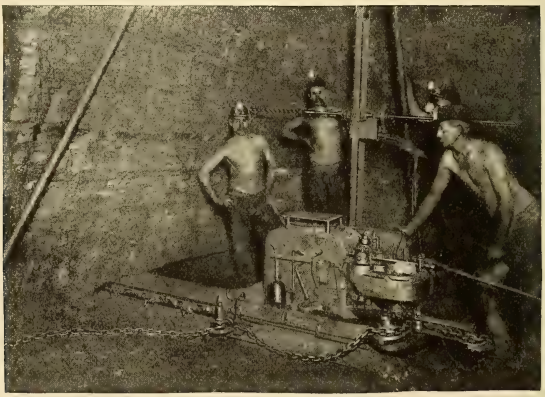
The results of the experiments also lead to the belief that the idea that electrical resistance disappears at the absolute zero of temperature, may be, and probably is, correct.

Coal Mining Machines in Australia

The use of mining machines has almost entirely replaced mining by hand pick in foreign mines as well as in those in this country. By "hand mining" is now meant, ordinarily, drilling holes in the working face of the coal seam, inserting explosives and blasting the coal out from the straight face of the seam by the mere force of the powder. This is a very dangerous practice, and one which is responsible for many of the serious accidents which are so often reported.

Mining machines are of two patterns: one operated by compressed air, which makes a wedge shaped cut underneath the coal similar to that made by the hand miner with a pick; the other, operated by electricity, sometimes by compressed air, makes a cut four to six inches high and from 3½ to 6½ feet deep, parallel with the floor at the bottom of the coal seam. This cut may be seen behind the front of the machine in the accompanying picture which shows a Sullivan coal cutting machine in a coal mine in Queensland, Australia.

In mining coal with this machine, it is first brought into the room or working place mounted on its self propelling carriage or trunk. It is then dragged to either the right or left hand side of the room under its own power, by means of the feed chain shown in the picture. It is then started feeding under the coal, until the full length of the cutter bar is reached. The jacks, or supports, are then reset, so that the feed chain is stretched across the entire face of the room. The machine cuts across the face, making a continuous undercut or mining, without being withdrawn from the coal until the opposite side of the room is reached.



SCENE IN AN AUSTRALIAN MINE—THE UNDERCUTTING IS DONE BY SHARP BITS ON AN ENDLESS CHAIN. IN THE BACKGROUND IS AN AUGER DRILL MAKING BLAST HOLES

The cutting is done by sharp bits, or cutters, seen in the foreground of the picture. These run on an endless chain on sprocket wheels, one at each end of the cutter bar, and are driven by an electric motor through gearing.

The horsepower of this machine is 30. The picture shows the machine partly withdrawn from the coal, presumably to cut around a ball of sulphur, or some other impurity.

In the background of the picture is

shown an electric auger drill, with which the blast holes are drilled in the face of the coal, after it has been undercut. When coal has been mined in this way, it is necessary to put in only three holes in a working place, one in the center and one on each rib, and a dozen or fifteen pounds of powder is ample to break down the entire face.

Storage Battery Cars in Trains

A marked step in the development of electric railway operation has been taken by the Unidos Habana, an electric railway company in Cuba. It will operate storage battery trains such as the one shown in the picture, which was taken during a recent try-out from New York City to Long Beach, L. I. Single storage battery cars of this type, built by the Federal Storage Battery Company, have been successfully operated in a number of cities in this country. But never before had the operation of trains of these cars been attempted.

A large element in the success of the operations of the trains is the special direct current Diehl motors used on the cars, all the motors being coupled together electrically by a clever system of multiple unit control handled by a single motorman. The batteries on the cars are of the Edison type, 200 cells being located under the seats in each car.

TRAIN OF STORAGE BATTERY CARS OF A TYPE WHICH WILL BE OPERATED IN CUBA

Curious Case of Electric Shock

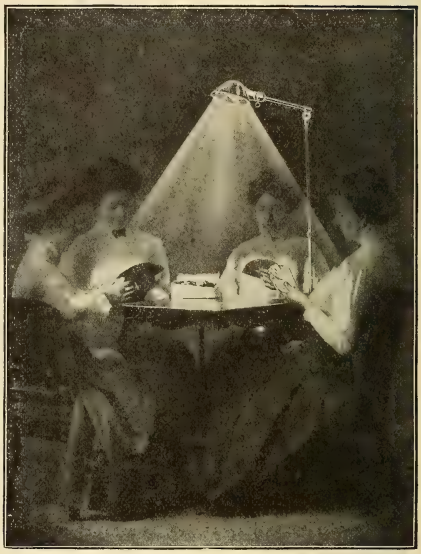
An interesting case of electric shock without fatal effects was presented before the Academy of Medicine of Cincinnati by Dr. Merril Ricketts recently. The victim was Walter Still, one of a number of men engaged in dismantling a water tower on Price Hill, a suburb of the Queen City.

Some months ago the man was engaged in rigging a derrick, and in some manner his head came in contact with an electric wire charged to a potential 35,000 volts. This voltage was impressed directly upon his body, from the crown of his head to the soles of his feet. Still was rendered unconscious and hurled a distance of 30 feet. The only evidence of his injury, however, is a hole in each of his feet, and these are healing rapidly.

Portable Floor Light

A portable floor light is so convenient in the home that it may almost be classed among the necessities. At card parties, sewing parties, as a reading light, piano light and in many other ways it adds to pleasure and convenience. The Morse light shown in this picture has a six foot telescopic upright, with a one foot arm that can be swung or tilted in any direction. No thumb screws are needed to control the adjustment. It thus can be adjusted to any height, or to any position in a second. It is made also with flexible instead of stiff arm.

The upright is of brass with a brass socket and shade to match. The base is of iron covered with spun brass. It is also furnished in other finishes, such as polished or old brass, verde, bronze or gun metal.



Electric Circus-Museum Train

An electric special or traveling side show has been inaugurated by the Alabama Southern Railroad. It is made up of a train with specially constructed cars equipped with all sorts of electrical devices, like washing machines, cookers, floor scrubbers, cleaners, pumps, irons, toasters, automatic kitchens, tables, rarebit tureens, candy machines, and the like. Direct connected motor driven outfits such as coffee mills, bone grinders, meat choppers, shoe shiners, hat cleaners, sewing machines, windmills, water filters, house pumps, are in two of the cars.

Still other cars—the train is transported from village to village by a gasoline electric locomotive with a storage battery equipment—were fitted out as a fully equipped electrical department store with cash arrangements on electric switches, electric cash registers, counters, lighting arrangements, push buttons, electrical timing devices, electrical shelves, show cases, stairways and card systems. Even an electric typewriter and adding machine was there.

The car that interested the children most was an electric toy shop and play room. Here an electric Santa Claus bowed and handed out picture cards, beneath an electrically trimmed Christmas tree. An electric fountain spouted in an electric garden, where an electric railroad, with semaphores, telegraphy, telephone, wireless, and other electrical novelties were busily doing their expected work. An electric trolley system vied with several small aeroplanes and electric automobiles in picking up and letting out electrically manipulated figures.

In another car, a moving picture and marionette show was given. Electrically manipulated lay artists sang by means of a graphophone run by electricity and were accompanied by an electric piano, banjo and 'cello. The moving pictures

showed in an amusing way the wonders of modern applications of electricity.

Movable Laboratory for Air Surveys

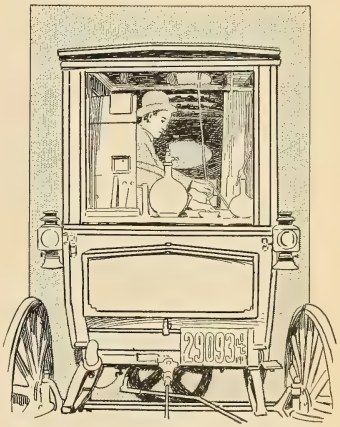
The effects of atmospheric pollution in public halls are pretty well defined and it is not a difficult operation to analyze the atmosphere of a laboratory in which the various devices are permanently installed, or to which samples of air in bottles may be taken, but the problem of testing the atmosphere of a great city, in the many parts of the city and with the use of sufficient volumes of air to insure average conditions at the point investigated, and to determine accurately those constituents existing in minute quantities in the air, is a problem that has been most uniquely worked out by Mr. William Hoskins of Chicago in a portable laboratory containing apparatus for the express purpose of conducting air analyses at many different points.

An automobile delivery wagon with a closed body was secured and the car is operated by the ordinary two cylinder engine. The runs cover about eight hours and are made during the day and at night. In designing the arrangement of the apparatus, account had to be taken of the fact of transporting glass bottles and flasks over rough streets, so the wagon was fitted with shelves and each flask is held firmly in its place by a tiny strap. A storage battery, an electric motor, and a pressure pump are the essential features of the portable wagon.

The air is drawn in through a specially devised filter so controlled by a weather vane that it always turns the filtering surface towards the direction from which the wind is coming. The filter waylays all dust, soot and carbon particles, then it goes through a series of flasks and absorbing solutions. The amount of carbon dioxide and other chemical constituents is determined in this way.

The electric motor operated by a storage battery is connected with a pressure pump, thus drawing the air through a specially arranged filter and then through the various absorbing solutions. The amount of carbon dioxide is determined every hour and a half throughout the test and the total quantities of sulphur compounds, nitrites, ammonia and chlorine are also determined. A barometer, hygrometer, a wind gauge and other apparatus are carried and frequent determinations of the meteorological conditions of the atmosphere are recorded.

The dust collected in the cotton filter



AIR SURVEY LABORATORY ON WHEELS

is weighed and a microscopic examination is made to determine the nature of the material collected and photo-micrographs are made.

There is scarcely a period of electrical development, starting with the early days when Edison was but a stripling, that has not felt his influence. Follow his progress through the patent records of the world. In the telegraph business, the telephone business or the electric light and power business, it will be found that in each one he has greatly distinguished himself, and has probably effected at least three-quarters of the electrical development of our time by the product of his mind.

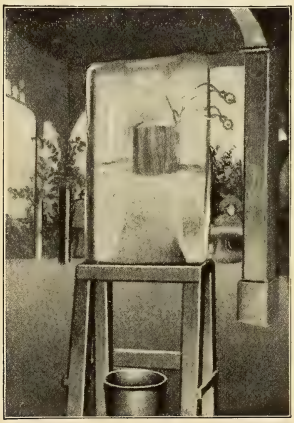
Lightning Rods to Protect Threshing Machines

Threshing machines out in Republic County, Kansas, were equipped during the threshing season with lightning rods as a protection to the machines during the fierce electric storms so frequent in that time of year. It is said that lightning destroys more machines than all other causes combined.

Storage Battery in a Cake of Ice

A storage battery actually doing work while frozen into the center of a solid cake of ice was the novel sight which met the eyes of visitors to the recent automobile show in St. Louis.

The Leutwiler battery which underwent this unique test was first lowered into a tank of water and remained there 40 hours while the water was slowly

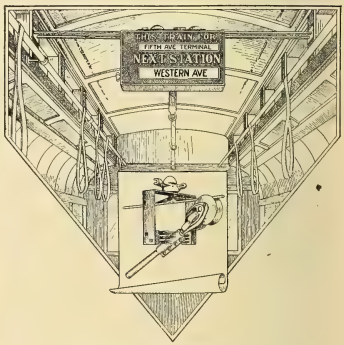


STORAGE BATTERY IN A CAKE OF ICE

congealed into a solid cake of ice. Then the lamps were connected to wires left projecting. These wires were not even insulated, to the surprise of most of the observers, demonstrating the fact that ice is a very good insulator. Otherwise a heavy current would have passed from wire to wire through the ice and practically short circuited the battery.

Street Indicator for Electric Cars

The street car passenger who is anxious to get off at the right street and whose confidence in the guard or conductor has been sometime rudely shaken by being carried by his destination on a



STREET INDICATOR IN A CAR AND THE TROLLEY BRUSHES WHICH OPERATE IT

stormy night may now sit back unperturbed and read the next station or street upon an indicator in the car. Not only that but the point to which the car goes is also shown. One of these indicators is shown installed in a car.

To operate the indicator automatically a brass collar on the trolley pole carries current through a wire in the center of the pole whenever the pole passes metal brushes placed at proper intervals along the line as shown in the illustration. The manual method of operation is to have two push buttons, one to run the machine in one direction and one to run it in the other, placed within reach of the conductor, who then pushes the proper button upon leaving each station which causes the machine to display the name of the next street or station.

Vibrating the Whole Body

The vibration of the street car and the railway passenger coach has upon many people the effect of an opiate—a sleepy, soothing feeling is experienced. Whether or not this has anything to do with the invention of the vibrating chair the same principle is observed.

AN ORDINARY VIBRATOR IS CLAMPED TO A CHAIR

The accompanying picture illustrates the application of vibration to the whole body by attaching a White Cross electric vibrator by a clamp to a chair. The vibrator is the same as is used in massaging the face or body. Those who have tried the vibrating chair treatment assert that it stimulates the circulation, induces sleep and imparts a natural healthy tone to the system.

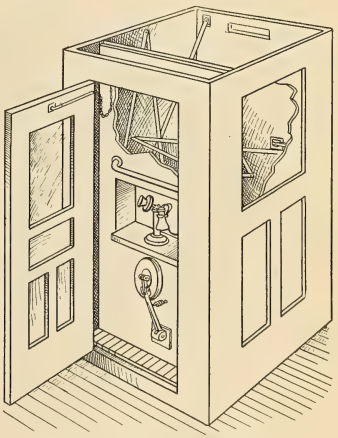
New York public service commissioners are the best paid in the country; they receive $15,000 per year each. South Dakota commissioners receive least of all, their salaries being $1,500 a year. Members of the other 45 state commissions and one federal commission receive between $1,900 and $10,000 per year. These commissions have in the aggregate no less than 156 members.

Ventilated Telephone Booth

William Douglas Carter of Quincy, Illinois, recently received a patent upon an invention to effect a change of air in a telephone booth after each occupancy.

The general plan is indicated in the illustration in which a sort of "fan door" is shown, the roof and part of the side of the booth being cut away in the drawing for the sake of clearness.

A person entering the booth pushes the fan door inward, thereby causing fresh air to flow into the booth through the open entrance door, and the air in the



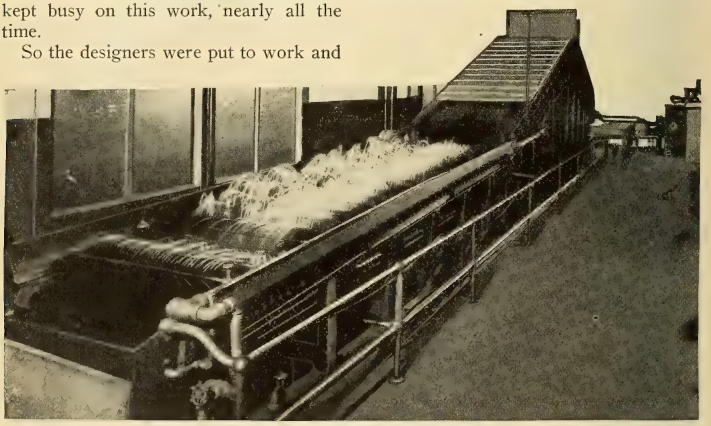
VENTILATED TELEPHONE BOOTH

booth to flow out through an opening in the back of the booth. As the fan door is pushed inward the entrance door is nearly closed by a chain. A dead center spring forces the fan door against the back of the booth and a stopper closes the air opening in the back of the booth. The folding stool may then be pulled down and the telephone used. When the user opens the entrance door to leave, the chain pulls the fan door forward forcing out dead air and admitting fresh air behind it.

A Blue-Print Machine

A certain large manufacturing plant employs a special corps of designers, architects and draftsmen, while its own school for draftsmen and designers turns out a great number of blue prints. Some time ago this concern began figuring on the time consumed in washing and drying these blue prints. The manager who did the investigating found that out of the crew of ten photographers, four were kept busy on this work, nearly all the time.

So the designers were put to work and



MACHINE FOR WASHING AND DRYING BLUE-PRINTS

the machine shown in the illustration was finally produced. It consists of little more than a series of rollers and pipes. The blue print sheet is fed between the rollers, which are continuous, and as it goes down the line the sprinklers (shown at work in the picture) develop and wash it thoroughly. The blue print then passes on to other rollers, which squeeze it uniformly, and rid it of water, finally passing it on through a heating section, and bringing it out dry and ready for use at the other end. The affair works automatically and is run entirely by electricity. It requires almost no time or attention, and turns out thousands of blue prints each year perfectly.

The Golden Arc Light

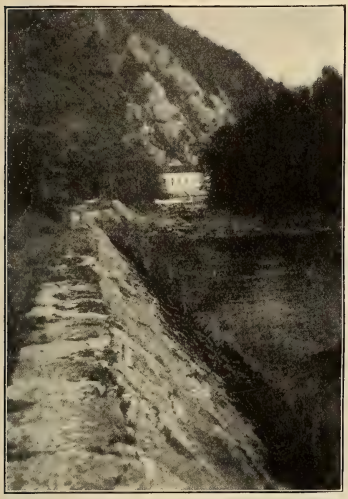
In place of the pure white glare—cold and unkind in its whiteness—of the usual form of arc light, a still more glaring radiance, but of a soft and pleasing golden color, is now frequently seen, produced by what is familiarly called the flaming arc.

The golden color of this light is due to a peculiar preparation of the carbon pencils, which are said to contain the salts of various somewhat rare minerals; but the exact constituents are not revealed by the manufacturers.

The golden arc light gives a curious spectrum quite unlike the continuous band afforded by ordinary carbons, which is very similar to that of daylight. The spectrum yielded by the new carbons is discontinuous, and consists of a number of brilliant strips separated by spaces of darkness. The red, orange, and green are especially conspicuous, while blue and the colors beyond it are scarcely represented. The carbons have the disadvantage of giving a somewhat unsteady light, and for this reason they are used principally for outdoor work.

Adding Charm to the Picture

On the Areuse River in the Canton of Neuchatel, Switzerland, there is located a pumping station which supplies water to a town on the farther side of a mountain 1500 feet high. To do this the pumps



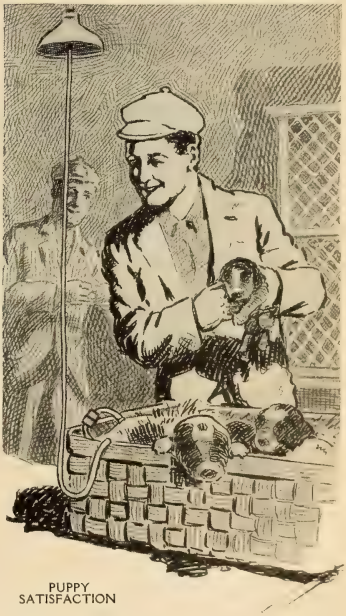
A LITTLE SWISS PLANT THAT ADDS THE FINISHING TOUCH TO A MOUNTAIN SCENE

must force the water up through the pipe against the enormous pressure of 825 pounds to the square inch. Ordinarily this is done by waterpower turbines in the riverside plant shown in the picture, but when the water is low in the river two electric pumps in the plant help out with the work, the motors taking their supply of current from a nearby power station.

The Swiss, as a people, have an eye for the artistic, especially as their mountains and rivers and lakes form a picture gallery for the whole world, and they are very careful never to mar any of their natural scenic attractions. When a power station or any other plant of this nature is set among their hills and mountains you may be sure it will enhance rather than detract from the picture. Not the least interesting feature about this little plant, therefore, is its admirable setting, and whether intentionally or by accident it has been made to add the finishing touch to a charming mountain view.

Puppies Appreciate Warming Pad

A rather odd use of an electric heating pad was made in a western kennel. A litter of puppies came into the world while the thermometer hung around the freezing point. To make the newcomers comfortable they were placed in a clothes basket along with a heating pad set to operate at the first degree of heat, and they snuggled down to the source of warmth with a frank display of puppy satisfaction.



PUPPY SATISFACTION

When a University Holds Open House

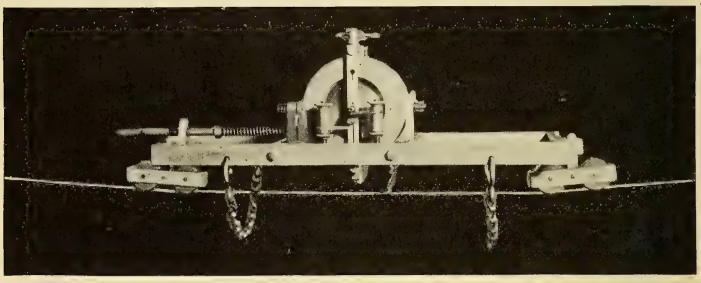
BY D. L. GEYER

If we should happen to be in Champaign, Ill., some evening in January, we might be startled to see high above the tops of all the buildings, an enormous kite and sign, sharply outlined by the rays of a distant searchlight. In large letters the sign reads "Attend the Student Electrical Show Tonight."

Should we follow the crowd out through the streets of the college town toward that searchlight we would come at length to the dimly looming buildings of the University of Illinois, to the closely packed group forming the College of Engineering, and finally to the large structure devoted especially to the study of electricity. And here we would find ourselves at an electrical exposition given by the student body of a university—an exposition whose evening throngs of "town and gown" are increased to the very limit of the building's capacity by trainloads from the neighboring cities on either side. At the exposition this year, in the early part of February, many of the features of last year's exposition, here described, will be embodied, and likewise many new ones.

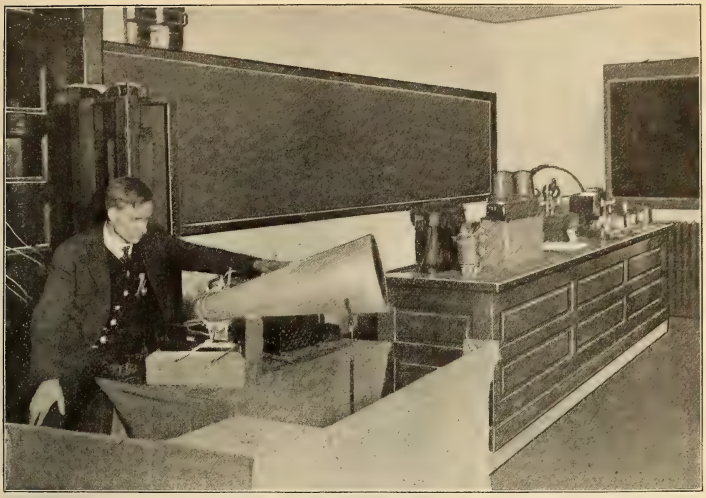
Every other year, we learn, the seniors of the Electrical Engineering Society plan a set of "stunts" or demonstrations that shall illustrate some of the more practical and simple applications of the theories they are learning, and then, without any assistance from the faculty whatever, manage it for better or worse in their own way.

When our eyes have become accustomed to the brilliant and many colored lights shooting across the large laboratory, we see a series of picturesque booths set about in pleasant irregularity, each containing an operator who is busy in explaining some piece of apparatus to the crowd which continually pushes in about him. Here at the left is what looks like a moving picture show. Yes, a film is running off and is illustrating each step gone through with in the ordinary production of electricity. Every detail of the process is shown, from the coal bunkers to the Mazda lamp, and an accompanying explanation by phonograph makes all of them clear even to a layman.



A GYROSCOPE CAR; IT CANNOT BE DISLODGED EVEN BY SWINGING THE CABLE

Now here a little farther on is a "stunt" that reminds one of sleight-of-hand. The magician is lighting lamps merely by touching them with the tips of his fingers. The booth is marked "High Frequency Exhibit," and an assistant is explaining that a strong current



A VOICE IN A DISTANT ROOM, SPEAKING OR SINGING INTO AN ARC LAMP CIRCUIT, IS REPRODUCED AT THE FUNNEL—AN EXPERIMENT UNUSUALLY FASCINATING

is being passed through the seeming magician's body, but because it is alternating at a frequency of hundreds of thousands cycles per second it is harmless to him. Harmless it plainly must be, yet it is powerful enough to cause the lamp he touches to glow finely.

But what is this crowd in the center? With a good deal of merriment they are watching the operation of a model nursery. This illustrates, perhaps, a typical night's events. At first all in the booth is dark, an electric alarm goes off, an electric lamp lights up, and an electric fire starts burning and heats a bottle of milk. An electric motor rocks the baby's cradle, "jumps" the baby-jumper, and even operates an automatic slipper-spanker.

We stroll on past those booths which seem to contain demonstrations of an especially technical nature. Of these there are several, and around them are numerous faculty people and upper-class students absorbed in discussion of some of the fundamental principles here involved. But it is those exhibits of a less intricate kind which seem to draw the attention of all except these few specialists.

Here is a sign "Apples, Take One." But obviously this was devised by some undignified freshman and not by the aforesaid absorbed graduates. For as we reach in to "take one" from the tub of water in which they are floating—what a jerk and a tingling shoots up one's arm. We release that apple with a quick impulsive gesture of disdain.

This very large booth over here in the corner is the model kitchen. Shining with polished nickelware and burnished copper, it seems to hold every conceivable cooking device from chafing dishes to coffee grinders, and from corn poppers to complete kitchen cabinets. And the utensils are not here merely to be looked at, but are showing what they can actually do, with ten very pretty co-eds to hand out the delicacies.

Heated Glove for Auto Drivers

The matter of keeping the motorist's hands warm while driving the car in winter has given rise to more than one patent, some of these applying to methods of heating the steering wheel itself. However, the most practicable method, in the light of experience, seems to consist in heating the glove itself by means of resistance wires imbedded in the material of the inner glove, after the manner of the ordinary electric heating pad. The illustration shows such a glove and its application.

The current is drawn from the storage battery with which most cars are provided, either for ignition or lighting purposes, or, in an electric car, from the regular battery. The amount required is about equal to that taken by a six candlepower side or tail lamp. Flexible conducting wires are brought up from the two terminals of the battery and connected, one to each of two metal plates placed at the proper points on the rim of the steering wheel. The resistance wires in the glove terminate in the metal buttons shown on the glove, one on the thumb and two on the palm at the base of one of the fingers. As the driver grasps the wheel, these glove terminals come at the right position to connect with the two terminal plates on the wheel and the circuit through the glove is connected in this way.

It is pointed out that the wire used in these gloves is not only very pliable, but is placed in the gloves in such a way as to avoid all short bends, making them very durable, and also surprisingly flexible. It is claimed that in case it does break, the inner glove can be easily replaced in a few seconds at a low cost.

ELECTRICALLY HEATED AUTO GLOVE

Electrically Heated Baptismal Fount

There is a church in Northern Michigan where there has been difficulty in maintaining a sufficiently high temperature of the water in the fount in which those that profess the faith are baptized, so that the ceremony could be conducted with comfort to the convert. The problem was effectively solved, however, by installing an immersion electric heater in the basin.

A heater of the copper clad immersion type was selected. With a heater of this type, the resistor, which by being heated by the passage of the electric current imparts heat to the water, is entirely enclosed and hermetically sealed in a copper jacket so that it can be thrust into the liquid. Obviously, all of the heat generated in the heater must pass into the water; hence the arrangement is very efficient. There can be no waste of energy, as all energy entering the heater as electricity passes into the water in the form of heat.

A short time prior to the time that the

baptismal fount is to be used, the sexton closes the switch that connects the immersion heater to the electric lighting mains. The water is comfortably warm when the service commences.—CHARLES D. CARREY.

Cut Glass Electrolier and Vase

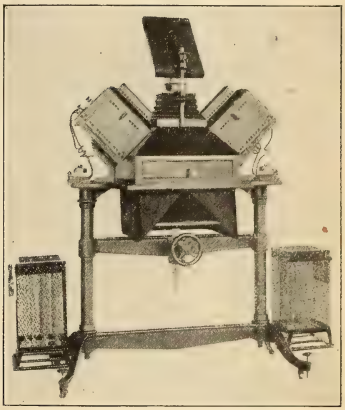
Cut glass in the presence of electric light always produces a brilliant, not to say, dazzling effect. A combination electrolier and vase in which this effect is prominent is presented in the accompanying illustration. The base and arms are of white metal silver plated. The vase at the center is detachable for cleaning and refilling. The electrolier is 21 inches high and is equipped with pull sockets, cord and plug.

COMBINATION ELECTROLIER AND VASE

There is one telephone for every fourth person in Stockholm, Sweden, including children and servants, the highest number per capita in the world.

Projecting Images of Opaque Objects

While opaque projection is not new its successful application to the projection of large objects has only recently been made possible by the modern development of electrical apparatus. The Balopticon, as it is called, will not only project upon the screen clear images of small machines and other solid objects but also full page illustrations from large magazines, or photographs and engravings of any size up to 20 inches square. In educational work, too, lie some of its greatest possibilities for service as it is especially suitable for projecting large embroyos and anatomical specimens. All subjects are clearly shown in their natural form and coloring in greatly enlarged images, conveying a certain sense of the true relation of the parts projected.



LANTERN FOR PROJECTING OPAQUE OBJECTS

In order to reach the attainment of such a wide scope of service this apparatus was constructed with an opening for objects measuring 20 inches square. To cover this wide area with sufficient illumination to the very edges was the first problem to be solved. This was successfully accomplished by mounting two large

90° arc lamps in light tight houses at a suitable angle to the object table to cover the exposed area with the cones of light, and without the use of condensers.

After obtaining the maximum amount of illumination for the area to be covered, the next problem to meet was to utilize this light for obtaining the most efficient image possible. To this end a high grade photographic anastigmatic lens was employed—of 19¾ inch focus and 47/16 inch diameter. This is a lens of unusual covering power for its speed and proves no less effective in projection than in photography.

There is a mirror required above the projection lens to direct the image toward the screen, since the objects are held in a horizontal position because of their size and weight. This also serves an important purpose as a reversing mirror, so that objects, illustrations and printed matter are shown on the screen in their true position.

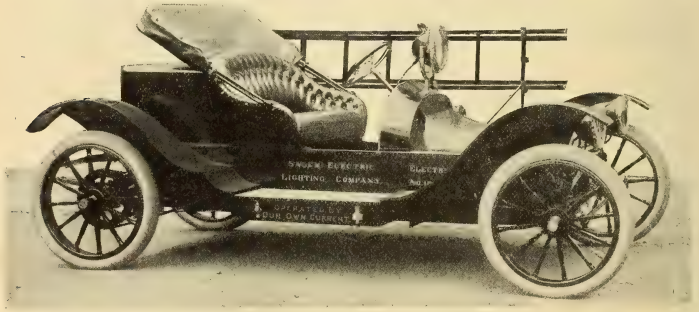
Electric Car for Maintenance and Lamp Trimming

The central station company which advertises electricity for power and lighting purposes and which uses other than electrically propelled vehicles for lamp delivery, repair and maintenance purposes, loses an opportunity for profitable advertising, for above all, it would appear to the consumer that the company itself should use its own product. In the illustration is shown a Bailey electric runabout equipped for arc light trimming and repairs. Space for globes, electrodes and other parts is obtained by using the running board boxes and the large box behind. It is capable of running 100 miles, at an average of 20 miles per hour, on one charge of the new Edison storage battery at a cost of 1.4 cents per mile with current at five cents per kilowatt-hour. The motor and control apparatus is placed under the hood which is so designed that it offers the least possible resistance to the wind.

Electric Railway Without a Trolley

There operates out of Minneapolis, Minn., one of the most novel and interesting railroad systems in the world. This system is owned by the Minneapolis, St. Paul, Rochester and Dubuque Electric Traction Company. At present, the road operates between the southern limits of the city of Minneapolis and Northfield, Minn., a distance of 38 miles, but by next summer it expects to operate 40 miles additional.

The novelty of its construction and operation lies mainly in the fact that it is operated by gas-electric motor cars for power. No trolley wire or third rail is used. Power is developed first by a gas engine on each motor car. This power



AN ELECTRIC LIGHT COMPANY'S MAINTENANCE CAR

GAS-ELECTRIC CAR RUNNING OUT OF MINNEAPOLIS

is used to drive a dynamo, which in turn furnishes electric current to operate the car motors. Each motor car therefore carries its own independent power plant and electric system.

During the coldest months of the winter of 1911 and 1912, when all steam and electric cars in the state of Minnesota were forced to operate far behind regular train schedule time, this line ran smoothly and promptly, a train schedule never being missed. This remarkable record was due in the main to the fact that during the heavy snow storms and extremely cold weather, no roaring fires had to be kept up, as in steam locomotive operation. There were no steam pipes to freeze up or burst, no water tanks to freeze, no trouble at coaling stations, no heavy counterbalances on the wheels to break rails in cold weather and cause delay and accidents, no fires to be cleaned or flues to blow out. Neither were there any overhead trolley wires to sleet over and break nor power house to break down.

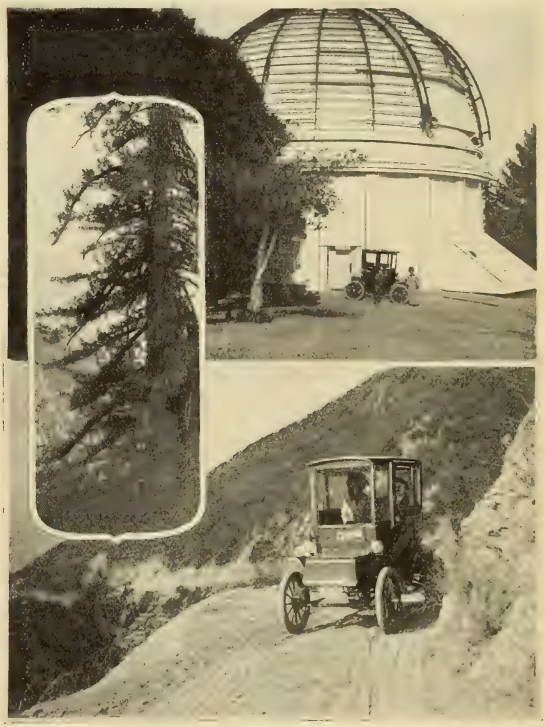
The method of control and power application is essentially the same as that of an ordinary electric car but has an additional advantage in that the dynamo voltage is varied by the controller to produce speed changes of the motors, thus providing a smooth and rapid acceleration without loss of power. The engine is entirely enclosed, eliminating all wear from dust and dirt. On down grades it is possible to lower the speed of the engine and still maintain the desired car speed, thus reducing the wear on the engine bearings. The radiators, located as they are on the roof, are protected from damage by flying stones, etc. The entire power plant in the gas-electric motor car is within easy reach of the operator.

Loud Speaking Telephone at Ball Games

Loud speaking telephones are promised as first aids to the baseball fan next year. These telephones will be placed in various parts of the grandstand, the transmitting system being in the press box. The telephones will announce each batter as he steps to the plate. They will also serve to call doctors and other spectators to the public telephone to receive messages. This baseball adjunct will be of real benefit, if it is not abused. It could easily be abused by a continual dinning into the ears of the fans of calls for promoters, politicians, and other modest self-advertisers.—*Electrical Record.*

Mountaineering in an Electric

A short time ago the toll road up Mount Wilson above Pasadena, Calif., was improved so as to be available for motor cars, but as the grades are nowhere less than ten per cent and range as high as eighteen per cent, the trip has been attempted by none but experienced drivers of gasoline cars. There are nine and a half miles of this road, a steady uphill pull, with exceedingly sharp curves,



THE OBSERVATORY ON THE SUMMIT OF MT. WHITNEY AND THE LITTLE ELECTRIC THAT CLIMBED UP TO IT

a straight drop on the down side and a corresponding cliff on the upper side. It is certainly the last road on earth that one would consider suitable for an electric coupé.

Yet such a car made the run to the summit of Mount Whitney in October of this year. It is the property of Mrs. Volney Beardsley, a Los Angeles woman, who has previously used it for her shopping or social calls—a little Columbus electric coupé.

From the garage in Los Angeles to the foot of the grade is a distance of 22 miles and this part of the trip was made over the smooth boulevards in an hour and a half. The start was made from the toll house at the foot of the mountain at ten minutes past ten, and with two passengers the car began the ascent, very soon encountering grades that ranged from fourteen to eighteen per cent.

After a run of 2½ miles over a road of this character the car was stopped for the purpose of taking pictures, and it was found that they had been 26 minutes on the way. The batteries and motors were tested for heating and were found to be only slightly warm.

From Schneider's Camp the grades became steadily worse and the curves were difficult; wheel tracks showing that cars of longer wheel base had been forced to back and start afresh to negotiate the abrupt turns.

At nine miles from the toll house the car was taking 75 amperes at 56 volts, and the driver was beginning to feel a trifle worried as to whether they would pull through. He cheered himself with the reflection that there was only half a mile more to make, gritted his teeth and went to it, and at half past twelve drove up in front of the Mount Wilson Inn on the summit. Here again the motor and batteries were tested for heating and found to be perfectly satisfactory, having a temperature of not more than 95 degrees.

Dinner was enjoyed at the Inn and then came a little run around the plateau on the mountain top, a beautiful park-like area, overgrown with tall pines. Here are built the little bungalows that serve as sleeping rooms for the guests of the hotel and the astronomers of the Solar Observatory. The car was drawn up before the solar tower and the big white dome of the observatory to be photographed.

The view from this summit, which has an altitude of 5895 feet, is magnificent. In fact, it is one of the finest mountain trips in the world, more than 30 towns being visible from the Inn.

The return trip began at three o'clock and if the climb was an extreme test for motor and batteries, the descent was no less severe on the brakes. However, they held back the 2800 pound car without heating and the nine and a half miles of the down hill slide was accomplished with no great difficulty. After this, the little electric sped back to Los Angeles, an additional 22 miles, on its own power, completing one of the most remarkable trips ever undertaken by an electric car.

Electrolytic Copper Refining in Norway

For several months a company at Aamdal, Norway, has been successfully extracting copper from the crude ore by an electrolytic process invented by Victor Hybinethe, a Norwegian engineer who has patented the process in Europe and the United States. The Aamdal works have proved so successful that plans are now under way for increasing the output to three tons of metallic copper per day.

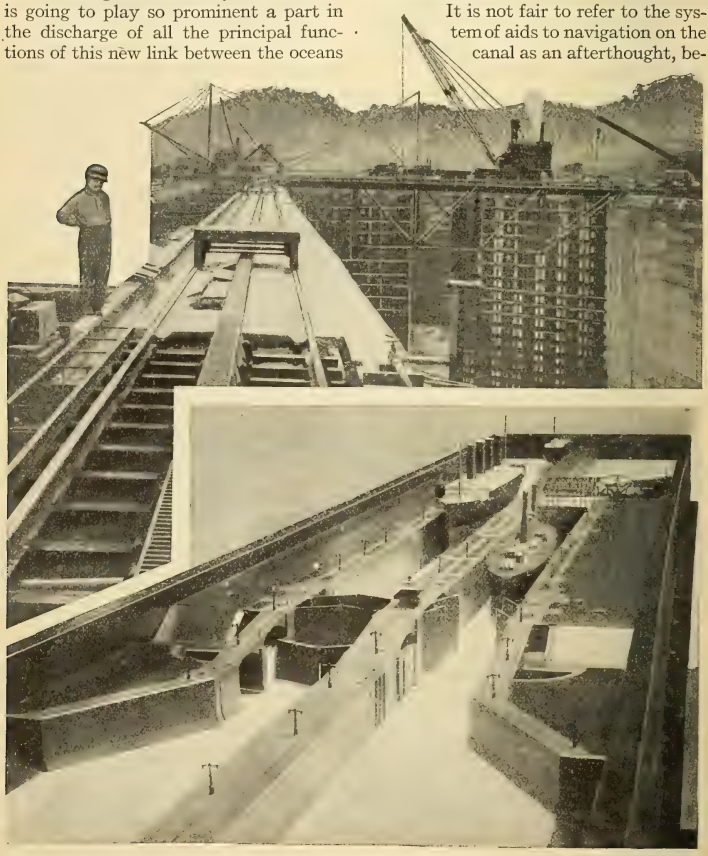
The treatment, which is done at the mine and thus results in enormous shipping economies, consists in leaching the crushed ore with a solution of sulphuric acid which dissolves out the copper. A strong current of electricity is then passed through this solution and the pure copper is precipitated. The new process will mean a great deal to the copper industry of Norway.

Aids to Navigation on the Panama Canal

BY WALDON FAWCETT

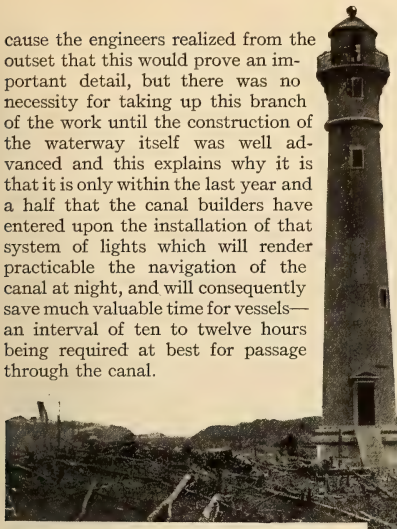
One of the newest utilizations of electricity in connection with the Panama Canal project is as the illuminant for the aids to navigation—the lighthouses, range lights, buoys and beacons on the line of the great waterway. Electricity is going to play so prominent a part in the discharge of all the principal functions of this new link between the oceans that the big ditch might almost be denominated the "electric canal," and now one more sphere of electrical influence has been added to those of which the public has already heard in connection with the undertaking at the Isthmus.

It is not fair to refer to the system of aids to navigation on the canal as an afterthought, be-



THE UPPER VIEW SHOWS PEDRO MIGUEL LOCK AND THE RACK TRACK WHICH WILL CARRY THE ELECTRIC TOWING LOCOMOTIVES. BELOW IS THE MODEL LOCK WHICH WILL OPERATE IN UNISON WITH THE REAL LOCK, FOR THE GUIDANCE OF THE MAN WHO CONTROLS THE LOCK GATES

cause the engineers realized from the outset that this would prove an important detail, but there was no necessity for taking up this branch of the work until the construction of the waterway itself was well advanced and this explains why it is that it is only within the last year and a half that the canal builders have entered upon the installation of that system of lights which will render practicable the navigation of the canal at night, and will consequently save much valuable time for vessels—an interval of ten to twelve hours being required at best for passage through the canal.

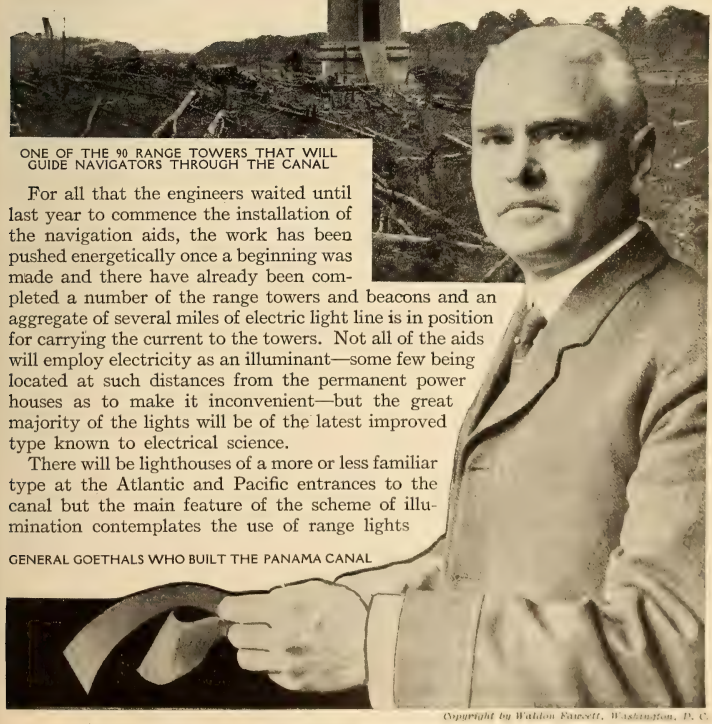


ONE OF THE 90 RANGE TOWERS THAT WILL GUIDE NAVIGATORS THROUGH THE CANAL

For all that the engineers waited until last year to commence the installation of the navigation aids, the work has been pushed energetically once a beginning was made and there have already been completed a number of the range towers and beacons and an aggregate of several miles of electric light line is in position for carrying the current to the towers. Not all of the aids will employ electricity as an illuminant—some few being located at such distances from the permanent power houses as to make it inconvenient—but the great majority of the lights will be of the latest improved type known to electrical science.

There will be lighthouses of a more or less familiar type at the Atlantic and Pacific entrances to the canal but the main feature of the scheme of illumination contemplates the use of range lights and of side lights, spaced about one mile apart, to mark each side of the channel. The range lights, will, however, be omitted in the Culebra Cut, where the use of such aids is hardly practicable.

All the lighted beacons are of reinforced concrete and the undertaking at Panama will therefore constitute the most severe test yet made of the serviceability of concrete for lighthouse construction as well as of the value of electricity as an illuminant. There will be, all told, about 90 tower beacons ranging in height from 29 to 74 feet. The more elaborate structures are being pro-



GENERAL GOETHALS WHO BUILT THE PANAMA CANAL

Copyright by Waldon Fawcett, Washington, D. C.

vided at the Gatun locks and dam and in the Atlantic and Pacific divisions of the canal, where these beacons will be located close to the sailing lines of the vessels passing through the canal. Simpler structures will be placed in Gatun Lake where the beacons will be under less close observation.

The electric lights in the towers will be of from 2,500 to 15,000 candle power according to the length of the "range." The most powerful lights will be in the sea channel and will be visible from twelve to eighteen miles. In addition to the powerful range lights there will be a number of beacons of 900 candle power each. It will be necessary, of course, that the various range lights, all of which will be plain white lights, shall be invested with distinctive characteristics in each instance in order to enable identification by the mariners on passing vessels. This will be accomplished by a system of flashes, different in the case of each tower.

As the canal locks at Panama approach completion, visitors to the Isthmus are more and more deeply impressed with the fact that the crowning marvel of the canal is to be found in the electrically operated gates of the various locks. The lock gates are steel structures seven feet thick, 65 feet long and from 47 to 82 feet high. They weigh from 300 to 600 tons each and the 92 leaves required for the entire canal will have a combined weight of more than 57,000 tons. Electricity, generated by water turbines from the head created by Gatun Lake will operate the gates and also the valves controlling the culverts, by means of which the lock chambers are filled and emptied.

The gates may be compared to huge doors swinging on hinges and meeting at an angle in the center of the lock chamber. They will be moved from the closed position to the opened position, back into recesses in the side walls, by means of powerful electric motors. The motors for each system of locks will be controlled by one man from a single switch house. Here the operator will sit with a miniature of the lock and gates before him, this miniature operating in exact synchronism with the real system quite a distance away, and by the movement of a few simple switches he will control the movements of the great leaf gates and other apparatus at the lock.

Paralleling in interest the use of the magic current for operating the lock gates will be the employment of electric locomotives for towing ships into and out of the locks. No vessel will be permitted to enter or leave any lock chamber under her own power, and, as a rule, at least four of the big electric locomotives will be assigned to each vessel. Two locomotives, one running on each lock wall ahead of the vessel, will pull the craft while two other locomotives in similar positions opposite one another on the walls but in the rear of the ship will aid in keeping the craft centered in the lock and will also serve as a brake to bring the boat to rest when she is entirely within the lock chamber. The electric locomotives will run on cog rails on the tops of the lock walls and not only will there be two towing tracks for each flight of locks—one on the side and one on the middle wall—but there will be one return track on each side wall and a third return track, common to both of the twin locks by reason of its location on the middle wall. All of these electric tracks will run continuously the entire length of the respective flights of locks and will extend some distance on the guide approach walls so that the electric locomotives will have ample latitude of action in manipulating their unwieldy tows.

When the Pearl Street Station was started in New York in 1882 it cost the public 1.1 cents to burn a sixteen candle power carbon incandescent lamp for one hour. It now costs a maximum of only two-tenths of a cent or less than one-fifth of the original cost, to obtain a equivalent illumination of even better quality, or if the current be purchased in large quantities, one-twentieth of the original price.

Manila's New Hotel

In the new Manila Hotel, a magnificent concrete structure seven stories high the first passenger elevator in that part of the world has been installed, and it

NEW MANILA HOTEL CONTAINING THE FIRST ELECTRIC PASSENGER ELEVATOR IN THE PHILIPPINE

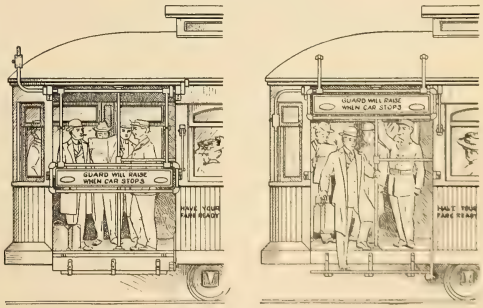
is operated by electricity. In fact, "juice" plays a decidedly prominent part in the equipment of the new hostelry. The several hundred rooms in the building, nearly all of which have private baths, are lighted by electricity, and all the grills kitchens, the laundry, and bar rooms have the latest electrical appliances. In the towers on the spacious roof gardens are located what are locally known as the aeroplane cafes, and these are lighted by electricity.

A beautiful system of sunken gardens will surround the building, and when open air fêtes are on, as is often the case in the tropics, arc lamps will be brought into use. The rooms also have inter-communicating telephones and a thoroughly reliable call-bell service. No better electrical equipment can be found anywhere, which speaks well for the electrical progress in our far-off island possessions.

Street Car Safety Device

Broken arms, broken legs, bruises and sometimes more serious injuries happen to street car passengers who alight or board the car before it stops, and there are always some on every trip who are willing to take a chance.

While doors operated by the conductor when the car stops are in service in some cities, the safety guard with folding step is a new device to accomplish the same purpose. The guard, supported by hinged metal work, extends across the entrance when the car is in motion and is raised by the conductor when the car stops. It may be made to work in connection with an adjustable step.



A DOOR GUARD FOR STREET CARS

Electrical Men of the Times

ROBERT F. PACK

Biographies of prominent men make little if any mention of the silent partner —the woman—who in no small measure molds for success or failure the future of her mate. But the story of Robert F. Pack, the new general manager of the Minneapolis General Electric Company, Minneapolis, Minn., would be very incomplete without mention of his accomplished helpmate and three beautiful children, a boy aged seven, and two girls of five and three. A noted sociologist gives as one of the rules for a successful career, "There should always be a center upon which, outside of working hours, an individual's interest is concentrated," and to Mr. Pack this center is his family.

Mr. Pack was born in England 38 years ago and was educated for the British Navy. Abandoning the idea, however, and believing opportunities for a young man to be better in America than in England he came to Canada in 1889 and two years later accepted the position of office boy with the Toronto Electric Light Company. It soon became evident,

however, that there was much more than office boy material in the lad and he was promoted, becoming in turn chief accountant, comptroller, secretary, and then general manager.

As manager Mr. Pack was held in high esteem by those under his supervision and this feeling of the employees was obtained by contact, for he made it a point to get acquainted with every man as far as possible. The one thing, however, more than another for which he is remembered in Toronto is for both preaching and practicing that there should be a progressive management of public utility companies—that is, a "square deal" for the people and a fair return on capital invested, with generous treatment of employees. Mr. Pack firmly believes that this policy will solve most of the troubles of public service corporations. When he became general manager, the newspapers of the city, owing to the operation of a municipal plant, were decidedly antagonistic. Within a short time, however, this attitude was entirely changed and when leaving for his present position he could count everybody as a friend from the mayor down.

Mr. Pack's policies received a most favorable approval from Adam Beck, Minister of Power and Chairman of the Ontario Hydro-electric Commission. Mr. Beck asserted that instead of being allowed to leave Canada Mr. Pack should have been chosen to manage this great hydro-electric project.

During his management of the Toronto company the employees were organized into a strong company section of the National Electric Light Association, thus starting the movement in Canada. He also brought about the affiliation of the Canadian Electrical Association with the National Electric Light Association. Upon the occasion of his leaving Toronto to accept his present position he was presented with a handsome silver loving cup by the heads of departments of the Toronto Electric Light Company.

Mr. Pack served as President of the Canadian Electrical Association and is ex-officio member of the executive committee of the National Electric Light Association. He is an Associate Member of the American Institute of Electrical Engineers, also a member of the Engineers' Club, the Albany Club, the Arts and Letters Club, and the Royal Canadian Club, all of Toronto.

Long Run of an Electric Car

It is sometimes stated that electric cars are only adapted for short runs, and are not practical for bad roads. Although electrics are most frequently used for city and suburban service, yet the run recently made by a Borland-Grannis electric from Chicago to Milwaukee on a single charge of its Hycap-Exide battery proves that the electric car will give long mileage and can be satisfactorily operated under adverse weather and road conditions.

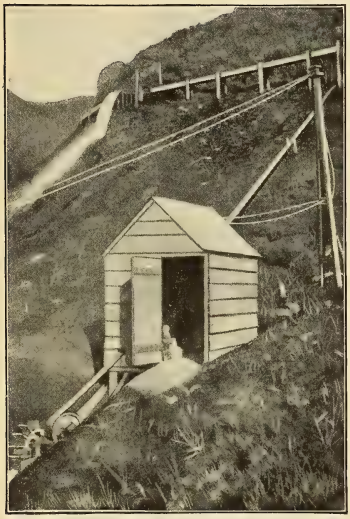
The car covered the 104 miles from Chicago to Milwaukee, and for 54 miles of this distance the route was over muddy country roads.

Measuring Wind Velocity

Recently an electrical method for the determination of wind velocity has been proposed. Copper wire changes its electrical resistance as the temperature is varied. This is true of many metals. Alloys of metals have been produced which do not change perceptibly in their resistivity when their temperature is varied. Notable among these alloys is manganin. If two wires consisting of these materials, copper and manganin, are placed in the open air and at the same time are connected as two arms in the well known Wheatstone bridge, their relative change in resistance can be measured. Due to the cooling effect of the wind the bridge is "unbalanced" and this amount of unbalance can be determined once for all in terms of wind velocity. The cooling effect of the wind increases with its velocity.

A Plant in the Bush Land

One of the subscribers to this magazine, Mr. H. O. Johnson, an old time sailor but now a farmer in New Zealand, is located on 500 acres of bush land, rich in possibilities but most tenacious and tough when it comes to the matter of



A FARM ELECTRIC PLANT IN NEW ZEALAND

clearing away the great stumps and logs which are left from the primeval forests. He has this to say concerning the use of electricity there:

"I must confess that I am a novice at electricity and take the magazine to enlighten myself, being too old to go through all the theory attached to it. But I see immense possibilities here as this is a mountainous country and great quantities of water power going to waste. This country is ruled by theoretical Solomons, which generally means practical dunces. The country is almost asleep as far as electricity is concerned."

He is of the opinion that electric current ultimately is going to aid the farmers there to a great extent, for most of them have water power on their property, and he is planning now to put such a plant into operation on his farm. Some of the farmers have already made a start in this direction as will be noted from the picture which he sends us.

This little power plant is on a New Zealand back country farm and is used to supply light, heat and power, and the expense of running it is practically nothing. The water from a little stream up the valley is brought in a flume along the hillside, then dropped through a pipe to the paddle wheel shown in front of the building. This wheel is geared to a pulley which drives the electric generator.

The White Way and the Chickens

We are now advised of the riotous living of chickens in Oklahoma, made possible through the medium of a brilliantly lighted thoroughfare. It seems that every night the fowls in a particular location in Oklahoma City leave their premises and congregate under one of the big electric lights. Also drawn to the vicinity of the electric lamp are innumerable grasshoppers, the chickens feasting with glee upon the toothsome bugs.

The attraction proves so alluring to the chickens that their owner experiences considerable difficulty in driving them back to roost. It is stated that sometimes the chickens remain up all night, going back to roost about daylight, the effect being that they are drowsy the following day and the hens do not lay.

The owner of the chickens blames a dissipated old rooster for the demoralization of his flock. He says the rooster was out late one night and discovered the grasshoppers. He gallantly called the hens and they left the roost to answer. Since then the hens have waited each night for the light to be turned on and the feast it brings to them.—*Good Lighting.*

FARM LIGHTS AND FARM MOTORS

AN IDEAL FARM HOME AT NIGHT

Three sources of supply make it possible for the farmer to obtain electric current. In many instances transmission lines from the city plant run along the highways and can be tapped. Again there is in the vicinity a stream which can be dammed at little expense, and, with the present development of the water wheel, be made to operate a dynamo of sufficient capacity to supply two or three farms.

But should neither of these means be available, the gas engine is, and it can be direct connected to the dynamo. With this equipment and a set of storage batteries no farm, however distant from the city, need be without electric light, heat and power. The gas engine plant is comparatively inexpensive to install, and can be operated at extremely low cost both in the matter of fuel and in attention required. For example, a Gray equipment here illustrated will run for ten or twelve hours generating electricity at an extremely low cost for fuel, which may be either gasoline, alcohol, distillate or kerosene (coal oil).

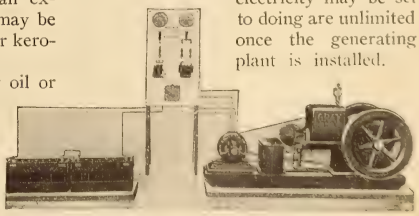
A twelve or fifteen horsepower oil or gasoline engine operating at full load will require about one pint of oil (kerosene) per horsepower per hour. A six horsepower engine will run at full load on one quart of oil per horsepower per hour.

The first appreciation of such a simply operated plant is found in the use of lights, at the turn of a switch, in the cellar, closets, barn and other formerly dark places. Its next advantage will be felt in the laundry, where it does the washing and where it makes possible the use of the electric pressing iron.

In the repair shop—and nearly every farm has one—an electric motor can be used to turn the grindstone, operate a lathe, run a saw, etc.

The creamery is another place where electric power can do its full share, for the cream separator, the churn, the pump and the butter worker can all be operated by electric drive.

About the barn and granaries electricity may be made to unload the grain and deposit it in bins, handle hay, cut fodder, shell corn, fill the silo, milk the cows, and so on. In fact the things on the farm that electricity may be set to doing are unlimited once the generating plant is installed.



TYPICAL FARM ELECTRIC PLANT

Electrical Interests of Women

EDITED BY GRACE T. HADLEY

The Blue Bird

The quest of the blue bird, a being perfect, elusive and infinitely to be desired is the subject of many old French fairy tales. In the play by this name the blue bird represents happiness. Maeterlinck wrote it as a Christmas pantomime, but it is full of symbolism. On the surface it is simple, a fairy play for young people. Grown-ups somewhat familiar with the mysticism of Maeterlinck might well exclaim: "How deep!" It typifies the experiences of the subconscious mind.

LIGHT, TIME AND NIGHT

Tyltyl and Mytyl are put to bed by mummy Tyl in the wood cutter's cottage. With the entrance of the fairy Berylune, the most wonderful things happen. Flame dashes out of the fireplace, water comes from the old fashioned hydrant in the form of a beautiful maiden, bread, milk and sugar come forth in amazing guise. The dog and the cat and all the common things with which the children are most familiar acquire a soul and become animated. The two children with their odd companions set out at the fairy's command to seek the blue bird. To young people the fairy is simply a fairy; to grown-ups Berylune may typify society; and society's child is sick—for what? Happiness, for something it has not and knows not how to obtain. Society in the world in the quest of new ideals of life and happiness sets in motion a dynamic force. Possibly grown-ups read something of the philosophy of the subconscious between the lines of a play that is so simple on the surface.

Tyltyl and Mytyl first visit the fairy Berylune's palace, then they go to the Land of Memory where they visit gaffer and granny Tyl and their little brothers and sisters who were once alive. They all have supper together. Gaffer Tyl sits at the head of the table with all the Tyl children about the table, while granny brings from the cottage a large lamp, which she places in the center of the table, and immediately the lamp lights up. After Tyltyl and Mytyl depart, gaffer, granny and the other Tyl children bend lower and lower until they relapse once more into the silence of death. The stage gradually darkens until nothing can be

seen except the light of the lamp in the center of the table, and then suddenly that goes out of itself, at least, apparently.

Throughout the play electricity is an important factor. Thirty-nine arc lamps and fourteen stereopticon machines are used for the many illusions and all of these are carried by the company; also they carry their own switchboard, with a much larger switch than that found in any theater they play. An electric signal box is used to signal cues to front light man (up in the gallery) and to the various parts of the stage and theater from which the lighting effects are worked. A special man is carried for the express purpose of operating the signal box. The electrical apparatus for staging the Blue Bird is very complicated, having been arranged and built for the great revolving stage of the New Theatre in New York, on which two scenes could be set up and prepared while another was being played. Thus no time was lost in changes. A local staff of electricians is engaged in addition to the regular staff when the play is presented in other cities which have not the same facilities as the famous metropolitan theater.

WATER AND FIRE NEUTRALIZE EACH OTHER

To those who are acquainted with Edison's way of doing things, it will be quite natural to assume that any country residence to which the above title could be applied would represent the latest in modern progress so far as comforts, conveniences and the absence of domestic drudgery are concerned.

The world undoubtedly regards the incandescent light and its system of operation as the great central invention in all of Edison's numerous and wonderful achievements. His original ideas, when he was working them out more than a generation ago, were centered on producing a system that should be capable of *universal* application; and although his immediate energies were then bent on central station lighting in large cities, he has always felt that our country cousins would in time come into their own in the enjoyment of comforts and conveniences similar to those which are available to the dwellers in large cities.

With the development of the storage battery and small gasoline engine in later years, this condition has been realized and it is now possible to introduce electric current into isolated country houses, no matter how remote they may be from a central station source of supply.

As this involves the operation of a gasoline engine, dynamo and storage batteries, it naturally follows that such an equipment must be greatly simplified, as the average householder cannot be presumed to possess technical or engineering ability. With the completion of his nickel-iron storage battery and its successful use in the hands of non-technical persons, Edison concluded that his plans for the universal use of electric current for light, heat and power could now be carried to fulfillment.

He had made his battery practically "fool proof." All it needed was to be charged and discharged and given a little clean water occasionally. The only other

necessities were a reliable gas engine, dynamo and an automatic regulator of the voltage. Such a combination could then be put into the hands of any householder whose only instructions would be to start the engine every second or third day, let it run a certain number of hours and then stop it. By so doing, the storage batteries would be charged and electric current would be available in the house or grounds wherever and whenever desired.

Such was the ideal combination planned by Edison. He therefore instructed his engineers to work it out accordingly and to hire a house in the vicinity, furnish it and install a complete plant to demonstrate the practicability of his ideas. "And make it a Twentieth Century house," said he, "with a plant that can be operated by a boy."

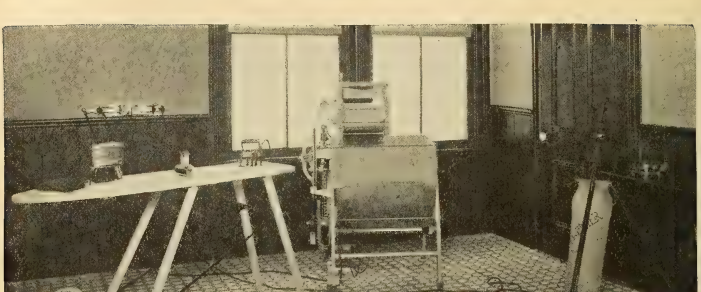
The troubles of his engineers then began. The storage battery was all right and there was an abundance of simple and efficient dynamos to be had, but the first difficulty encountered was to get a good gasoline engine. One after another was installed, tested and found to be lacking in some essential particular. Either they would not regulate closely or did not develop the rated horsepower. After a vast amount of testing and experiment, however, the right engines were at last secured.

The next difficulty arose over the matter of automatic voltage regulation. Edison's instructions were to preserve the highest efficiency and to this end he directed the use of tungsten lamps. While these are very efficient, it is well known that they will not stand much increase of voltage over their rating. Consequently, it was necessary to have a regulator which would automatically keep the voltage of the line constant, no matter if the battery was being charged or discharged at full or partial load. No such regulator was to be had in the market, and the matter was referred to Edison.

DINING ROOM AND COZY CORNER, SHOWING ALSO THE NEW EDISON DISK PHONOGRAPH

Just at this time he was about to attend the Byllesby banquet at Chicago, and said he would figure on it while he was away. He was as good as his word, and on returning presented quite a number of sketches showing many different plans for such a device. From these a thoroughly efficient and practical regulator was developed, and it has been put into use and standardized.

The last link in the chain having been forged, the initial demonstrating plant was installed in a typical country residence that had been rented in Honeysuckle Avenue, Llewellyn Park, West Orange, N. J., a short distance from the Edison laboratory. The interior of the house was painted, papered, decorated, handsomely



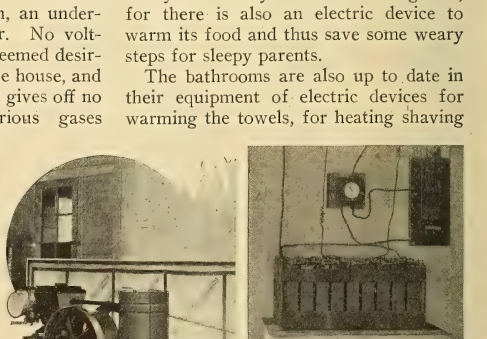
WASHING, IRONING AND VACUUM CLEANING APPARATUS—VERY ESSENTIAL IN THE TWENTIETH CENTURY HOUSE

furnished and wired throughout for electrict lights and with special service receptacles for fans, motors and other electrical devices.

The generating plant was installed in one of the stable rooms in a building near the house. This plant consists of a four horsepower gasoline engine and a 1¾ kw. dynamo, and near the latter is located a small switchboard upon which is mounted only a main switch, an underload cutout and an ammeter. No voltmeter is necessary. It was deemed desirable to place the battery in the house, and as the Edison storage battery gives off no noxious fumes or deleterious gases 27 cells of type A4 (150 ampere hours) were installed in the basement, and in close proximity were placed the voltage regulator and an ampere hour meter.

The distribution of lights in the house has been so planned as to produce the most effective illumination possible; 64 20-watt Mazda lamps are employed in the entire installation and these are placed in center drops and brackets, according to the requirements of the various rooms. The bedrooms are equipped not only with the usual side lights but there are also reading lamps for the bedside and, in addition, electric heating pads for warming the bed, together with electric foot warmers. Each room also has its electric fan for use in hot weather and milady's special requirements are provided for in devices for heating curling irons by electricity. The baby has not been forgotten, for there is also an electric device to warm its food and thus save some weary steps for sleepy parents.

The bathrooms are also up to date in their equipment of electric devices for warming the towels, for heating shaving



HEART OF THE SYSTEM—GENERATING PLANT AND STORAGE BATTERY

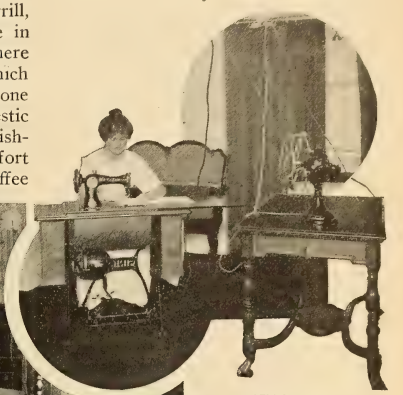
water and for sterilizing tooth brushes, besides apparatus for obtaining electric massage.

The cooking of meals and serving them piping hot is provided for by the installation in the kitchen of an electric grill, a broiler and a small electric stove in addition to the regular coal range. There is also an electric refrigerator which makes its own ice and a lightener of one of the most dreaded items of domestic drudgery in the shape of an electric dishwasher. Electricity adds to the comfort of the dining room also with its coffee percolator, toaster, chafing dish and egg boiler, all operated by the same current.

THE BEDROOM IS PROVIDED WITH A HEATING PAD AND A FOOT STOVE

In the laundry, the clothes are washed by an electric washing machine, after which they are wrung out by an electric wringer and ironed with electric irons. Domestic labor is further lightened with an electric vacuum cleaner which can be used in any part of the house. It is almost unnecessary to say that there is a full equipment of electric bells and telephones and the temperature of each room is automatically controlled in cold weather.

If the busy man finds himself unable to finish the day's work at his office, he may dictate letters or instructions to his clerks into the Edison dictating machine which is placed in the library. He can carry the cylinders to his place of business the next day for transcription, and thus start the day's work with a mind clear of unfinished detail.



SEWING ROOM CONVENIENCES

Entertainment has not been overlooked. In the billiard room there is a home kinetoscope for projecting motion pictures and in the drawing room there is one of the new disk phonographs—both of these described in the November issue of this magazine.

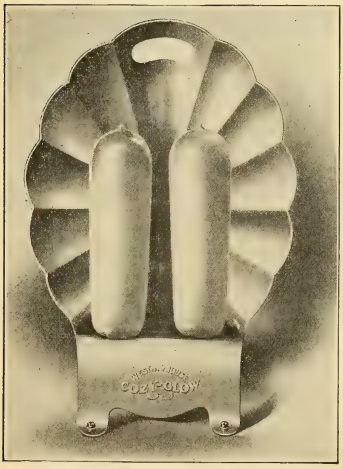
While a few gallons of gasoline transformed into electricity through the medium of engine, dynamo and storage battery is the basis of most of these marvels of Twentieth Century comfort and convenience, it is, after all, the perfect storage battery that really makes them possible and practical because of its simplicity and dependability.

No longer need the suburban dweller envy his city cousin the electrical delights and conveniences of the large city, for they are all at his command. Not only that, but another serious problem is solved, that of keeping the young folks

at home nights. A cheerful, bright home with plenty of amusement of a healthy kind will surely lessen outside allurements to young people. Again, the difficulty of retaining domestic servants is reduced to a minimum by the lessening of domestic drudgery and the increasing of cleanly surroundings with less labor.

The Cozy-Glow

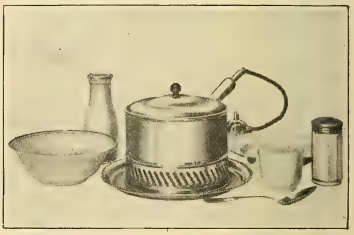
Every one appreciates the grateful heat and cheerful glow of the luminous electric radiator, the modern open fireplace. It is so very useful wherever a small amount of heat is desired quickly. The Cozy-Glow is especially desirable for the sick room, nursery and cozy corners, on account of the glow from the luminous heating units. Its cheerful glow acts like a tonic in the sick room. Children can play around it with absolute safety. It gives off no fumes and requires no chimney. It can be moved about the house as desired or put into the fireplace the same as a gas log.



A NEW DESIGN FOR LUMINOUS RADIATORS

Electric Saute Pan

The electric saute pan is a universal cooking utensil, designed to take the place, in a large measure, of the regular cooking stove in the kitchen. It will boil, fry, bake or roast, and is especially suitable for frying in deep fat. It is a utensil that is much appreciated by the up-to-date housekeeper for use in preparing special dishes without interference with the cook.



ELECTRIC SAUTE PAN

It is made of nickel plated steel and has a cooking compartment formed of heavily tinned copper welded to the frame. The heater is hermetically sealed in the bottom of the cooking compartment. There are three heats controlled by an indicating snap switch.

The Dream of Elias Howe

It is by no means uninteresting to know that Elias Howe, the Perseus of our compulsory needlework dragon, was taught in a dream how to make the sewing machine effective. The needle was where his invention hitched, and every experiment that he could devise had failed. One night he fancied himself in a vision pursued by a crowd of mischievous sprites, all brandishing needles and prodding therewith the poor inventor. Suddenly he observed that these needles all had an eye pierced near the point, and in a moment he understood that this was how to solve the difficulty.

A still further release from the drudgery of sewing, which was not dreamed of by Howe, is obtained through the electric sewing machine motor that makes sewing a real pleasure. By a light pressure on the treadle, the machine is operated at any desired speed. The material needs only to be guided and the sewing is quickly and easily done.

Dressing the Hair

It used to be considered the proper thing to follow fashion blindly, whether the prevailing styles were becoming or not. But nowadays clever women are realizing more and more that it is a

THE FLUFFY, WAVY EFFECT SO MUCH DESIRED

detriment to their appearance to follow styles that are unbecoming. Nothing makes a woman more unattractive than an unbecoming style of dressing the hair.

There is one style of coiffure that becomes nearly every woman, and that is the soft, fluffy, wavy effect. However, this effect is often difficult to achieve without the aid of a competent hair dresser or without proper appliances.

Electrocurl will produce any effect desired, from a soft, fluffy, natural appearance to a beautiful wave. This appliance gives continuous and uniform heat. It does not scorch or burn the hair. It also abolishes lamps, alcohol heaters and other dangerous and clumsy appliances.

Especial care should be taken in the selection of brushes and combs, the latter being very important. If a comb does not run smoothly through the hair, it should not be used at all. It was a custom in old times for maids to rub the heads of their mistresses with an old silk handkerchief. The excellent effects on the hair of electricity in silk was also experienced by old-time ladies who slept in silken caps.

Effects of Artificial Light on Hangings

The color of paper hangings and tapestries is far from being a minor factor in the degree of light that prevails in a room, and is very closely related to the economic use of artificial illumination also.

Recent investigations reveal the fact that the absorption of light depends, in the first instance, on the color of the hangings, and therefore on the same color when the walls are painted with it too. Naturally the most favorable effect of color in this regard is afforded by the white hangings and paints, but even these absorb 50 per cent of the light falling upon them, while the other 50 per cent radiates back into the room.

Following these in the effect of light come the yellow hangings, which radiate 45 per cent. The next in order are the bright greens, from which 40 per cent of the light striking them is thrown back. Dark green and red hangings exercise precisely the same influence; they radiate fifteen per cent.

Junior Section

Midnight Ride of 48-Ton Generator

Men who know what is best for generators, and incidentally what is best for the welfare of the residents of a great city like New York, hesitate to permit generators on the street in the daytime. That is why the little trip of the 5,000 kilowatt generator that is now being installed in the Edison station at Fifty-third Street was begun at the hour of one o'clock one morning a short time ago.

Although the entire trip covered a very short distance—not more than a few hundred yards—the tortoise-like pace at which it traveled caused it to be on the move until nine o'clock the next morning.

When it was decided that the streets were sufficiently clear of traffic, which was some time after midnight, cables were attached to the huge generator, and a series of eight inch rollers placed under it.

Then began the slow journey toward the Fifty-third Street Station. Inch by inch it moved ahead as the winch on board a five ton truck was started, and with the aid of rollers its slow journey was finally completed.

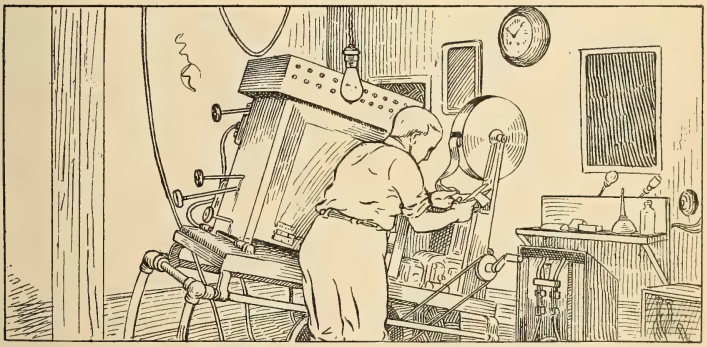
At one point it appeared as if the generator would experience some difficulties in making its journey, for it was thought that the elevated structures would not afford it clearance enough to pass under and on its way. By careful measurement it was found that there were a few inches to spare.

ON THE WAY ACROSS TOWN

THE MAN BEHIND THE "MOVIES"

The two business men stepped briskly down the aisle of the little theater and sank into the comfortable seats to participate in their daily noon hour indulgence—the moving picture show.

The brilliant stream of pictures against the screen depicted the inevitable "Cowboy and Indian" fracas with the usual number of hair-breadth escapes, horse races, pistol fights and hold-ups.



WITH FLYING FINGERS HE CUT, SCRAPED AND CEMENTED THE BROKEN FILM

One of the men leaned towards his companion and remarked, "Did you ever realize the large extent to which the human factor enters into those pictures; just how daring and reckless the actors will sometimes become to make a picture successful?"

His friend nodded in agreement and the two once more concentrated their gaze upon the active scene before them.

Suddenly the picture stopped. The piano player promptly commenced to thrump out a popular "rag" to allay the immediate signs of discontent which arose among the audience. The business men discussed the circumstance as "poor management," "incompetent operating," and used a number of equally expressive terms giving vent to their feelings. They had forgotten, or rather, neglected to realize that their remarks of the moment previous were particularly applicable to the case in hand, for in no place in the making and showing of moving picture films is the "human factor" so ever present and prominent as in the reproducing end.

In a galvanized metal cage, built in the back wall of the theater, sweating under the intense heat of a white hot electric arc, was the moving picture operator. The one-fourth mile length of celluloid ribbon had broken in a weak spot and he was, in a systematic yet rapid manner, repairing the break. The deviation of a one one-hundredth of an inch in matching the ends would have resulted in more serious trouble later on.

With flying fingers, he cut, scraped and cemented the broken film.

In the house an impatient audience commenced to grumble—to echo the sentiment expressed in the words of the two business men. A further delay meant their noon hour wasted.

With a sharp click, as the clamp swung in place over the perforated ribbon and the loud hiss of the arc steadied into a

musical humming, the wonders of western American scenery and activity were again unfolded before the absorbed gaze of the little audience.

In the narrow confines of his sweltering hot room, the patient operator turned the handle of the machine with unvarying regularity. Plainly speaking, it is "up" to him to reproduce with as great fidelity as he possibly can, the actions of the people in the pictures. He must gauge the speed of the film correctly so that the actions are normal. He must manipulate the blinding arc so that the resultant beam of light is concentrated to the highest possible degree—directly upon the little hole through which flutters the perforated ribbon of celluloid; this insures a bright clear picture. He must take more than conscientious interest in the delicate machine.

In the advent of a breakdown for any reason or other he is held accountable by a frankly critical public for a repair measured in seconds. At such moments, and only then, does the great horde of nickel theater goers ever give the "man behind the movies" a passing thought.

Giraffo Telephonia

Professor Burbank may be able to develop a seedless tomato or a tasteless prune, but he must share scientific honors with Maintenance Superintendent V. Ray, who discovered an old skeleton of a prehistoric animal, the "Giraffo Telephonia," which when rejuvenated may by a proper amount of training be taught to locate bullet holes in aerial cables and clear crossed wires in Chicago.

Our naturalist photographer, who never by any chance misses getting the picture of any rare species that may cross his path, followed this specimen the other day and actually caught the trainer Halberg putting it through a little cable trouble drill. Repairmen who care to learn to ride this fractious beast should file their applications early.

It seems strange, but it is nevertheless

GIRAFFO TELEPHONIA

a fact, that fourteen years ago this identical specimen traveled the streets of Chicago, and stranger still the Park Commissioners at that time gave orders to the Park Police not to allow either this machine or automobiles to drive through the parks on account of frightening horses. How times are changed! It is now nearly up to the point where horses will not be permitted to appear on boulevards for fear of frightening timid chauffeurs.—*Bell Telephone News.*

Cylindrical Lightning

What appears to be a well attested instance of lightning in the form of a cylinder is reported from Italy. At seven o'clock in the evening, at Rome, there was a brilliant discharge of lightning over the city, a glowing cylinder twelve inches long and ⅜ inch in diameter issuing from a wall at the point of attachment of a telephone wire. It passed horizontally over the table containing the telephone, and between two persons seated close together, and then went out

of an open door. A few seconds later an explosion was heard. None of the persons present felt any effect from the presence of the cylinder, which was silvery white, with a slightly bluish or violet tinge, and no noise or odor was detected during its presence, which lasted only a few seconds. The cylinder did not change its form.

Telling the Time at Night

Did you ever wake up, reach for your watch under the pillow and find that it was two hours earlier than you thought, and then because of your exertion fail to go to sleep again? Did you ever try to stay awake to hear the clock strike the hour and find that your next conscious thought was that you had somehow fallen asleep and overslept?

Some of these crimes against peaceful slumber are overcome by the electric ceiling clock here illustrated. Besides the clock there are reflectors, a battery and a small Mazda light. By pressing a push button attached to the end of a flexible cord the dial of the clock is lighted in such a way that the reflector throws a picture of the dial, hands and all, in light and shadow upon the ceiling of the room. The projected picture is about two feet in diameter.

AN ENLARGED REFLECTION OF THE CLOCK FACE IS CAST UPON THE CEILING

Birds and the Wireless

The view has been expressed in certain quarters that the behavior of birds, especially of gulls, in the neighborhood of wireless stations, indicates that the wireless waves interfere with the instinctive knowledge of direction which birds possess. In this connection attention has been invited to the unusual losses in homer pigeons since the advent of wireless telegraphy.

The sense of direction in birds has always been a mystery. The swallow does not guide itself by the stars, as the sailor does, for flight is more often made by day than by night. Nor does the bird make use of landmarks, so far as can be ascertained, since the flight is frequently led by the young. This "sixth sense" affords, therefore, some means of determining direction through a medium unknown to man. The flights of homer pigeons are less wonderful, except in the matter of speed, than the flights of the wild bird; yet they, too, have the migrant's gift and can travel wide seas as the season dictates.

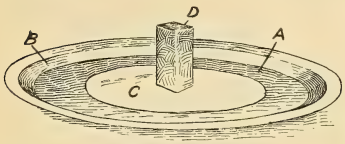
Of the traveling instinct and the sense of direction in birds, a plausible explanation is the theory that they and other animals have what has been called "the electric sense," in other words, they are, so

to speak in touch with the ether, that mysterious medium that conveys wireless messages. If the birds are so attuned, it is not difficult to imagine that the course of the earth, the incidence of the seasons and the movements of light convey to bird senses curious and certain intelligence. Upon the presumption, therefore, that living creatures can feel what the Marconi receivers record, it is easy to understand the confusion in a bird's instinctive sensations, and how these abrupt vibrations from the stations would war with the creature's previous electric experience.

To Make an Electrophorus

This instrument consists of two parts —a cake of sealing wax (A) cast in a round pie plate (B) and a round disk of tin (C) with a piece of sealing wax (D) as an insulated handle.

Place the sealing wax in the pie plate, and warm until it covers the plate uniformly. Cut from another pie plate a circular piece of tin smaller in diameter than the cake of sealing wax. Stick to this disk at the center a piece of sealing wax as a handle.

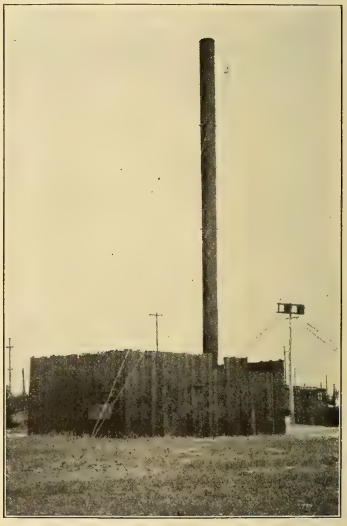


THE ELECTROPHORUS

To use the electrophorus, the sealing wax is rubbed with a warm piece of woolen cloth. The disk is then placed upon the cake, touched momentarily with the hand, then removed. The disk will be found to be charged sufficiently to yield sparks when brought near the fingers or hand. The tin disk may be charged many times before the sealing wax need be again rubbed.—Spenser M. Gowdy.

A California Rain Maker

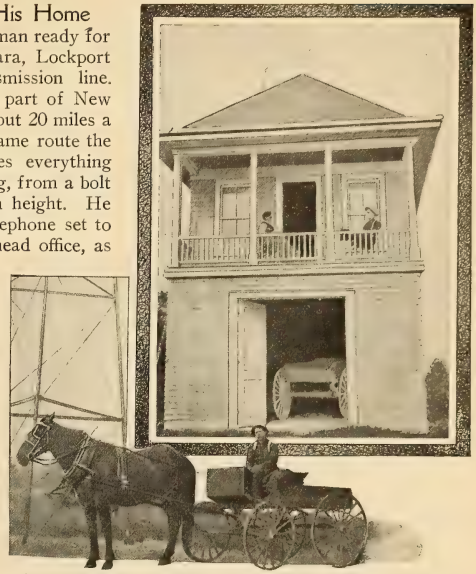
A device to cause the precipitation of moisture is being experimented with in Hyde Park, California, an electrically operated blower being used to force chemicals into the air through a huge upright tube. This is a steel pipe resembling a factory smokestack, and the top of it is 60 feet from the ground. At the base is the blower and a device for inserting the chemicals. The composition of the latter is the inventor's secret, and it is carefully guarded, together with all details of operation, by a high board fence and a padlocked gate. The tests are made at night in order to still more effectually balk curiosity. The results so far have not proved that the secret of "rain making" has been solved. The photograph shows all of the details which the camera is permitted to record, namely the steel pipe, the stockade, the power line, and pole transformer.


HEADQUARTERS OF A CALIFORNIA RAIN MAKER

Line Patrolman and His Home

This view shows a patrolman ready for his daily trip on the Niagara, Lockport and Ontario power transmission line. This line is in the western part of New York State. He travels about 20 miles a day and returns over the same route the following day. He carries everything that can be used in repairing, from a bolt to an insulator five feet in height. He also carries a lineman's telephone set to use in telephoning to the head office, as the company has its own telephone line. Along the line is a fine road bed, which enables the patrolman to travel near the line at all times. Part of one of the transmission line towers is seen at the left. These carry the three power cables.

One of the patrolman's houses is shown in the picture. He stays here one night and in one farther down the line the next. These houses are complete in every way.



A LINE PATROLMAN, AND THE COZY HOME IN WHICH HE LIVES

Each has its own bath, kitchen and dining room. There is a cozy sleeping room in the rear. The dining room is used as a loafing room. A well which is drilled at the rear of the house supplies fresh water. There is a barn and wagon shed in connection, forming the lower floor of the building.

Commended for Telephone Enunciation

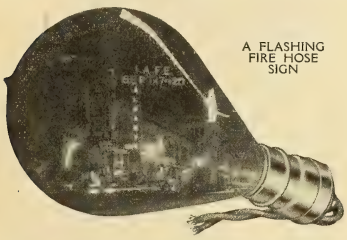
Recently a firm employed a new man in its office. He was called upon to transact considerable business with a neighboring concern over the telephone. A few days after his arrival one of the officers of the company met one from the other concern and was immediately asked about the new man. Upon inquiring the reason for this special interest, he was told: "His voice is as clear as a bell over the telephone and every word he utters can be understood perfectly." The person who made this comment talks daily with many people over the telephone, both local and long distance, but this one man's voice was the only one which was particularly noticeable to him, his interest being directed to it by the clear, pleasant enunciation.

The Wizard Lead Pencil

To make this requires some care, but it will furnish lots of fun. The things necessary are a lead pencil, with rather thick lead, and a sewing needle. Magnetize the needle, split the lead pencil along the glued joint, take out part of the lead near the end which is not sharpened, insert the needle and glue the parts together again. When this is carefully done the needle will not show. Tacks and other small articles can be attracted and held to the end of the pencil.

Flasher Display at Fire Chiefs' Meet

In front of the Albany Hotel, Denver, during the annual convention of the International Association of Fire Engineers, composed of the fire chiefs of the United States and Canada, stood an unusual


A FLASHING FIRE HOSE SIGN

electric sign. A fireman was depicted as playing a stream of water upon the hotel building.

The production, created by the Denver Gas and Electric Light Company, used 1,500 lamps. A flasher gave a realistic effect to the illusion of water shooting from the hose nozzle, the fireman's helmet was outlined with red lamps and his body and the hose were shown by clear glass globes.

Novel Use of Electric Current

An interesting use of electricity was recently demonstrated in England, where a wooden bridge was cut down by means of electrically heated wires. The bridge had been condemned and was to be replaced by a structure of steel supported on the old masonry piers and abutments.

Three weeks was allowed in which to dismantle the woodwork, but it proved impossible to accomplish the work in so short a time without the use of dynamite or fire, which undoubtedly would have injured the masonry. Finally an old electrician proposed to destroy the bridge by the use of electricity. Each span of the bridge contained 27 planks, and it was proposed to cut them so that they would drop into the water simultaneously, clear of the piers. The structure was wired and sufficient current was employed to bring the wires to a cherry red. An hour and 40 minutes after the current was applied the first span was cut and fell into the water.

Five Hundred Fifty Volt Fishing

The fish and game warden of Tippecanoe County, Ind., was much exercised during the past fishing season over the large quantities of fish offered by the dealers of Lafayette. Seines and nets he felt quite sure were not in use in his territory. Seeking for a time in vain he suddenly came one day upon a lone fisherman seated at the end of an interurban railway bridge and beside the angler lay a huge pile of fish. From time to time the fisherman indulged in the queer pro-

FROM TIME TO TIME THE FISHERMAN INDULGED IN A QUEER PROCEEDING

ceeding of striking his fishing pole against the trolley wire. Dead fish came to the surface following this action. Investigation showed that an insulated wire ran down the fish pole and dipped into the water under the bridge. The 500 volt contact with the trolley served to electrocute all fish near the wire.

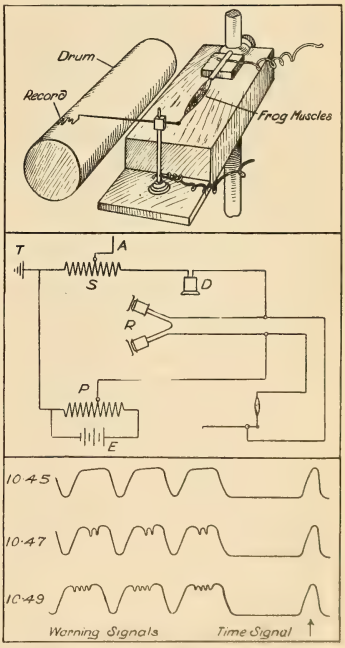
Wireless Signals Registered by Frog Muscles

M. Lefeuvre, professor of physiology in the medical school at Rennes, France, has recently described an apparatus by means of which radiotelegraphic signals may be registered on a revolving drum through the agency of a bit of frog muscle. The following observations on this subject are set forth by *La Nature:*

Every one knows of the galvanoscopic frog's leg, utilized since the time of Galvani by physiologists to study the electrical excitation of the nerves. This is simply a frog's leg from which the skin has been removed, cut off just above the knee and containing a part of the sciatic nerve. If the nerve is placed in an electrical circuit, the passage of a current causes the excitation of the nerve and the contraction of the muscle. If it is desired to register these movements, a lever can be attached to the extremity of the leg and a tracing point at the other end of the lever will give a series of curves which will correspond exactly to the movements of the muscle. The tracing point rests lightly upon a piece of smoked paper, and the apparatus is arranged so that the cylinder on which the paper is pasted is turned at a uniform rate by means of clockwork.

In applying this device to the reception of wireless messages M. Lefeuvre has employed a receiving station as shown in the diagram of connections. The aerial wire (A) is in contact with a tuning coil (S) which is also connected with an electrolytic detector (D). This detector is also in circuit with two telephone receivers (R), in series, each one of which has a resistance of 4000 ohms. The receivers are in connection with a potentiometer (P) placed in the circuit of an ammonium chloride battery of three elements (E) which communicates with the earth at (T). It is therefore an ordinary radiotelegraphic receiving station.

The frog's leg is simply an addition, and the two metallic wires leading to the nerve act as a shunt on the telephone receivers. The excitation of the nerve is



WIRELESS TIME SIGNALS REGISTERED BY FROG MUSCLES

due to the self-induction currents which have their origin in the coils of the receivers, and which are momentarily more powerful than the weak current impulse of the original wireless waves. In other words the receiver coils act somewhat after the manner of a "kick coil" used in gas lighting circuits to force a heavy spark across the gap.

Such an arrangement has enabled Dr. Lefeuvre, at Rennes, 210 miles from Paris, to receive and register the time signals sent out by the Eiffel Tower Station. The diagram of curves represents the registration of the signals at 10.45, 10.47 and 10.49. The muscle, responding to each excitation of the nerve, has transmitted the movement to the smoked paper on the revolving drum, which appears as a series of curves. The upper diagram shows very clearly the warning signals which correspond to the rhythm of the sending apparatus (twelve to fifteen per second). Then, after a moment's delay, comes the time signal. In the second diagram are seen the two small impulses within the waves of the warning signals, and in the third these small beats are increased to four. It will be seen that each time signal has the same form; consequently the only means of distinguishing them is by some difference in the warning signals.

The time elapsing between the emission of the wave and the registration of it by this means is about the one hundredth part of a second, that being the time which it has been calculated is required for the contraction of the muscle. Thus it will be seen that this method of registration is almost perfect, as the time consumed by the passage of the wave through the air is so small as to be inappreciable.

It is interesting to draw attention to this device because of its ingenuity. Of course it is scarcely to be expected that in practical working much use can be made of the frog's leg, as it loses its sensibility so quickly and consequently must be frequently renewed.

Wireless Unit Time in Germany

Germany will be the first country in the world to adopt wireless controlled clocks—these clocks to give uniform time all over the empire with a precision of one one-thousandth of a second. Norway, Sweden and Denmark have also secured the rights to the system and will follow shortly. A central station has been almost finished near the town of Fulda, Germany, and one standard clock located there will operate thousands of electrical clocks in every town and village of the empire by means of electric waves.

The central station in Fulda consists of one building, containing three standard clocks. Not far from the building is a tower about 330 feet high, carrying the sending antennæ. The central clock winds itself up automatically every minute, sending at the same time a wireless wave by means of the sending antennæ to all the receiving antennæ in the country. At the same time the minute hands of the receiving clocks of the system advance by one minute.

Each receiving clock has its antennæ on the roof of the house fastened to a special pole, or any number of clocks in a building, block or village can be connected with only one receiving antennæ by means of electric wire. Such clocks can be worked to a distance of about 800 miles from the central station.

Post offices, railway stations, etc., in Germany will be the first provided with the unit time and great interest is already shown by the public in general, the more, as the rent of the clocks is only $4.50 a year.

The new installation is of high strategic value besides, as the wireless apparatus all over the country can be made use of for military and telegraphic purposes.

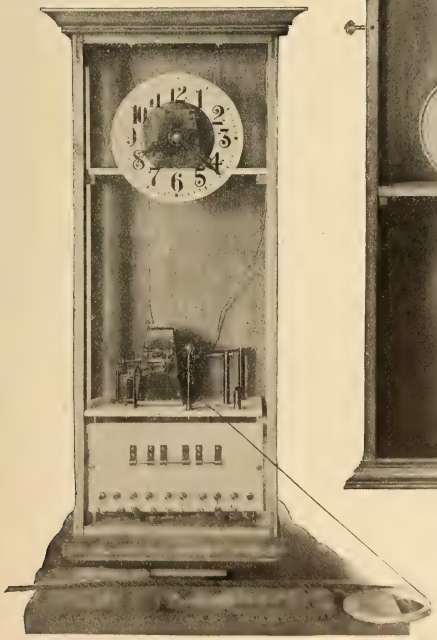
The inventor of this system is a German engineer, Mr. Schneider, the American rights to the patent being controlled by Alfred Graefe of Stapleton, Staten Island, N. Y.

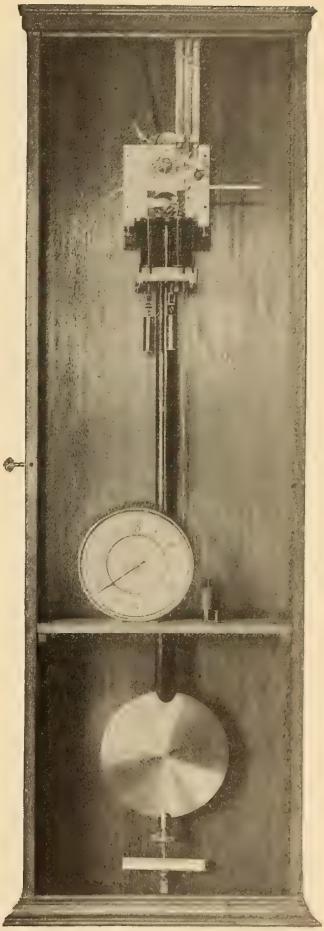
Wireless for Submarines

Recent experiments have demonstrated that it is possible to communicate with submarine craft from wireless stations on shore for a distance of 50 miles or more, and also to send wireless messages from submarines to the land stations.

The original experiments were unsatisfactory as regards the sending of messages from the submerged vessels, but it is now thought that these can be sent most successfully by means of a device attached to the submarine that will permit the raising and lowering of masts and a gaff above and below the surface of the water. These masts can be lowered to the upper deck when not in use.

Perfectly watertight connections permit the wires to enter the deck and pass down into the hull.





ABOVE IS THE SENDING CLOCK AND AT THE LEFT THE RECEIVING CLOCK OF THE WIRELESS UNIT TIME SYSTEM

Formalities to be Observed in Connection with the New Wireless Law

BY PHILIP E. EDELMAN

In the last two issues, suggestions for making amateur apparatus to comply with the requirements of the act of August 13, 1912, were given, together with a discussion of the provisions and effect of the new law. The present article, however, is concerned with further details and particularly with the steps necessary in order to obtain a license. The Department of Commerce and Labor has formed certain rules which must be complied with, and it is important that every experimenter should understand his rights and how to comply with the formalities.

The act took effect on December 13, 1912, slightly later than previously stated, and the regulations will be enforced by the Secretary of Commerce and Labor through collectors of customs, radio inspectors, and other officers of the government. Administrative districts have been established with offices at the custom houses of the ports named. These offices are located at Boston, Mass., New York, N. Y., Baltimore, Md., Savannah, Ga., New Orleans, La., San Francisco, Cal., Seattle, Wash., Cleveland, Ohio, and Chicago, Ill. Communications regarding licenses should be addressed to the radio inspectors at one of these custom houses or to the Commissioner of Navigation, Department of Commerce and Labor, Washington, D. C.

It is again pointed out that the act does not apply to stations for receiving only and which are not equipped for sending, nor to stations which are for transmission exclusively between points in the same state so that stations in other states are not interfered with, or to transmitting apparatus which does not interfere with the reception of interstate radiograms. If your station complies with the above limitations it is exempt from license, but if you are in doubt write the facts clearly and briefly to the Commissioner of Navigation, Washington, D. C., before applying for a license. If your apparatus is strong enough to transmit into a neighboring state or if it interferes with a local receiving station which receives from another state, it must be licensed.

Classifications have been made for the purpose of administration. The two main divisions are the coast stations and the inland stations. The coast stations are to receive the first attention, and attention will be given to the inland stations after the important coast stations have been attended to by the officials. Amateurs in inland states are asked to be patient, as licenses can not be issued to them until later. It is important, however, that your application should be made for a license at once and the officials will not take steps toward imposing penalties if it is impossible to act in your case before the law takes effect. With this exception, licenses are required before Dec. 13, 1912.

Both land and coast stations are divided into eight classes, five of which may concern experimenters and amateurs. Most of the readers will undoubtedly have their stations included under the class of *General Amateur Stations,* i. e., those restricted to a transmitting wave length of 200 meters and a transformer input of one kw. *Technical and Training School Stations* will be licensed in a separate class. If your station is located within five nautical miles of a naval or military station it is classified as a *Restricted Amateur Station,* and such stations are limited to a power imput of one-half kw. for transmission at a wave length not exceeding 200 meters. A few readers may be concerned with the other two classes, *Experiment Stations* for the purpose of research, and *Special Amateur Stations* with the privilege of using long wave lengths and large power. Special

qualifications must be given, however, and a convincing reason presented if such a license is to be obtained.

In addition to a license for your station it is necessary to have an operating or personal license. All licensed stations must be under the supervision or in charge of a licensed person or persons while in use and operation. Of the three classes of operators, two may concern the experimenter.

The most important is that of an *amateur operator.* Before applying for a license the amateur is expected to read and understand the essential parts of the Berlin Radiotelegraphic Convention and sections 3, 4, 5, and 7 of the act of August 13, 1912. Copies of these two publications may be secured for this purpose from the radio inspectors or by addressing the Commissoner of Navigation. (Be sure to state that you want them for this purpose, as they are not intended for public distribution.) The regulations prepared by the Department of Commerce and Labor state: "The Department recognizes that radio communication offers a wholesome form of instructive recreation for amateurs. At the same time, its use for this purpose must observe strictly the rights of others to the uninterrupted use of apparatus for important public and commercial purposes. The Department will not knowingly issue a license to an amateur who does not recognize and will not obey this principle." In addition to this prerequisite, it is necessary that an applicant be a citizen of the United States or Porto Rico or a company with similar qualifications.

Amateur operators are classified into two grades. To get a *first grade* license, the applicant must have a sufficient knowledge of the adjustment and operation of the apparatus, and of the regulations of the International Convention and acts of Congress in so far as they relate to interference with other radio communication and impose certain duties on all grades of operators. It is unnecessary to remember the other portions of these documents and a reading will serve to show the vital passages. The readers are advised to check off such passages for reference and study. The applicant must be able to transmit and receive in Continental Morse, but there is no speed limitation. The readers should aim to attain a speed of at least ten words a minute even though there is no prescribed regulation in this respect. In order to receive a first grade license the applicant is required to take an examination. A *second grade* license is the same as a first grade one except that it is issued where an applicant can not be examined or until he can be examined. Information regarding the officer to apply to as well as the place of examination should be asked for at the time when you apply for a license. Those who are unable to attend the examinations may be examined at home later, when the radio inspector makes a trip into their locality. If you are able to satisfy the examining officer or radio inspector that you are qualified to hold a license and will conform to its obligations and if further you can give reason for not presenting yourself for examination (as remote location from examining place, etc.) an actual examination may be waived.

Technical operators are classified into *experiment* and *instruction* grades. In either case a commercial first grade license is a requisite and must be indorsed by the Secretary of Commerce and Labor. Details will be found in the Regulations Governing Radio Communication issued by the Department of Commerce and Labor, Bureau of Navigation. (A part of this article is abridged from that document.)

The license provides for the taking of an oath before a notary public. This oath is for the preservation of secrecy of messages and need not scare the younger readers. A notary public or officer authorized to administer oaths may be found in every locality and in most cases the formality will be done for you gratis, "just to encourage you." The usual fee for a notary is not over 50 cents.

If you are not clear as to the exact procedure for your particular case, address the radio inspector, if there is one near to you, or else address the Commissioner of Navigation. The first thing to do is to write for Forms No. 756 and 757. These forms are self explanatory and should be filled in as directed thereon. Further forms will be sent to you after the filled in forms have been received at the office from which you obtained them. It will also be well to inquire, at the same time, as to the place of examination, and other points which are pertinent and on which you are doubtful. A request for copies of the act of August 13, 1912, and of the Berlin International Radiotelegraphic Convention, together with a copy of the Regulations Governing Radio Communication should also be made at the same time. As the time is short, readers are advised to do the foregoing and file their applications for licenses without delay. One of the forms asks for the approximate transmitting range. It will be safe to state this according to the rule of ten watts to the mile. Thus a one-fourth kw. station (250 watts) should be considered as having a range of 25 miles as a maximum, a one-half kw. 50 miles and so on. The other items of location, date, etc., will be understood without further comment. In sending in your forms, it is advisable to state whether or not you have read the act of August 13, 1912, and the International Convention provisions, as the regulations specifically state that amateurs who have read these documents will receive attention before those who have not. A license will probably be issued in about a month after the application is in. The readers are advised to fill out the blank forms carefully and to adhere to the formalities in order to avoid delay. Needless to say, the general observation given in the Regulations Governing Radio Communication should be considered. Copies of letters to the officers or Bureau of Navigation should be kept for reference.

Questions and Answers in Wireless

BY A. B. COLE

TUNING COILS (Continued.)

89. *How may the insulation of silk or cotton covered wires be removed to allow contact between the sliders and the wire?*

One of the best ways to do this is to heat an old file or a soldering iron and pass it along the wire coil where the insulation is to be removed. The insulation will be charred by the heat, and may then be removed by means of a stiff brush.

90. *Give dimensions of a good straight coil tuner.*

Diameter of core, two inches; length of winding, ten inches; size of wire, No. 20; insulation of wire, enamel; weight of wire, one-half pound.

If bare wire is used the length of the coil should be increased to fourteen inches, and the space between adjacent convolutions should be not greater than the diameter of a No. 14 wire.

91. *Give diagram of connections for single slide tuner, crystal detector and telephone receivers.*

See Fig. 25.

92. *What advantage has a double slide tuning coil over one having a single slide?*

Referring to Figs. 25 and 26, it will be seen that in the case of the single slide tuner, the aerial-ground circuit is common to that of the detector, since the detector is included in series with this circuit. In the case of the double slide tuner, the circuit involving the detector and the condenser is almost independent of the aerial-ground circuit, since the former circuit is connected to sliders, and since therefore its inductance and capacity can be varied almost independently.

The double slide tuner has, therefore, the advantage that the inductance and capacity of the aerial-ground and of the detector-condenser circuits can be varied

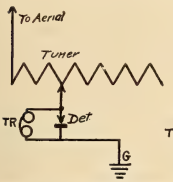


FIG. 25. CONNECTIONS OF SINGLE SLIDE TUNING COIL

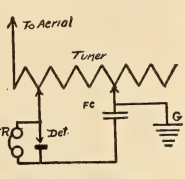


FIG. 26. CONNECTIONS OF DOUBLE SLIDE TUNING COIL

almost independently, and for this reason better tuning results.

93. *What advantage has the three slide tuning coil over one having two slides?*

Figure 27, a diagram of connections for a three slide tuner, shows that the inductance and capacity of the two circuits mentioned in answer to question 92 can be varied still more independently

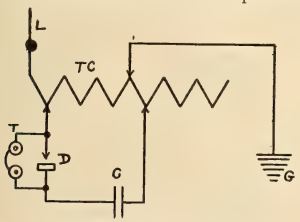


FIG. 27. CONNECTIONS OF THREE SLIDE TUNER

than is possible with a two slide tuner. Consequently very close tuning can be accomplished with a three slide tuning coil. By the use of this type of tuner the author is able to hear stations sending with a one-inch coil at a distance of one mile and at the same time to eliminate completely two high power commercial stations at a distance of fourteen miles.

94. *What advantage has a tuning coil using switches instead of sliders?*

At the point of contact between a slider and the wire of the tuning coil there is always a certain amount of resistance. The use of switches in place of the sliders will greatly decrease this resistance.

The use of switches has the disadvantage, however, that contact cannot be made with every turn of wire. The use of a variable condenser offsets this disadvantage to a considerable extent, however, and we have obtained very good results with a tuner of this type. Figure 28 shows the method of connecting the switches of a double contact tuner. The switch points should be connected to points of the wire not more than ten turns apart.

95. *What is a transformer tuner?*

A transformer tuner is one having two

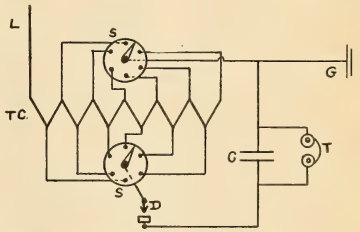


FIG. 28. CONNECTIONS OF DOUBLE POINT TUNER

layers of wire. This type of tuning coil is also known under the names receiving transformer, variable coupling tuner, loose coupled tuning coil and loose coupler.

The type generally designated as a receiving transformer has a primary and a secondary winding, so arranged that the secondary slides inside the primary. Figure 29 illustrates this tuning coil. The primary is provided with one slider, and variation of the inductance of the secondary is accomplished by means of a switch.

96. *Give dimensions of a good transformer tuner.*

Primary—4½ inches long, four inches in diameter, wound with one layer of No. 18 bare copper wire; secondary—four inches long, 3¾ inches outside

diameter, wound with one layer of No. 28 double cotton covered magnet wire.

The primary is provided with one sliding contact, and variation of the number of turns of the secondary is accomplished by means of a six point switch. The secondary is arranged to slide within the

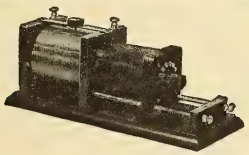


FIG. 29. VARIABLE COUPLING TUNING COIL

primary and can be moved out of it to a distance of seven inches.

97. *Compare the possible results to be obtained with a transformer tuner with those to be obtained with the three slide type.*

In the three slide tuner the aerial-ground circuit and the detector circuit are almost independent but are included in the same wire. In the transformer tuner these two circuits are entirely independent, as the distance between them may be varied at will. The transformer tuner is therefore more selective, which is an advantage under some conditions.

The signals from a distant station are necessarily weak, and unless the receiving station using a transformer tuner were exactly on the tune of the transmitting station it is doubtful that the signals would be heard. While the three slide tuner is not quite so selective, we believe that it is in many ways equal or superior to a transformer tuner.

98. *In a transformer tuner having a slide on the primary, how is it possible to make connection with any turn of the secondary wire when the secondary is entirely within the primary?*

It will be found that in nearly all cases when the secondary is in this position it will not be necessary to vary the number of turns in use within the primary, and any variation which might be of assistance can be obtained by the use of a variable condenser in series with the secondary and the detector.

99. *What advantage has stranded wire over solid wire in the construction of tuning coils?*

Stranded wire offers less resistance to high frequency currents than does solid wire. Since it is desirable to reduce all resistances in the apparatus to a minimum, the use of the former wire helps to increase efficiency.

100. *What is a variometer?*

This instrument (Fig. 30) consists of two coils of insulated wire, suspended in the same plane, and so arranged that the angle between them may be varied from zero degrees to 180 degrees. The variometer is therefore a transformer tuner in which the mutual inductance may be regulated by varying the angle between the two windings.

In one type of variometer the windings are not electrically connected. One end of the outer coil, which acts as the pri-

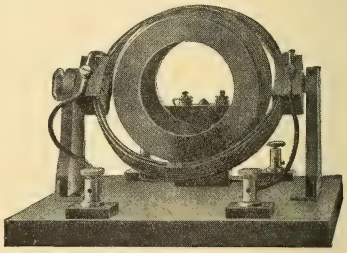


FIG. 30. VARIOMETER.

mary, is connected to the aerial, and the other end is connected to the ground. One end of the inner coil, which acts as the secondary, is connected to the detector, the other terminal of which is connected to the condenser, which may be of either the fixed or variable type, preferably the latter. The other end of the secondary coil is connected to the remaining terminal of the condenser. If the variometer will not respond to sufficiently long wave lengths, a single slide

tuning coil may be connected in series with its primary and the aerial.

In the second form of variometer both coils are wound in the same direction, and the outer terminal of the outer coil is connected to the outer terminal of the inner coil. The detector may be connected either in series with the variometer and the ground, as in the case of a single slide tuning coil, or across either of the windings in series with a variable condenser.

A few moments' reflection will show that when the plane of the inner coil coincides with that of the outer coil the inductance of the entire instrument will be minimum, since the coils will act magnetically against each other. When the inner coil is moved through an angle of 90 degrees from this position the inductance of the instrument will be increased, until when the angle has become 180 degrees, the inductance will be maximum. It will therefore be observed that a wide range of inductance can be obtained with this instrument.

The variometer gives very satisfactory results as a tuning coil, especially in stations receiving from transmitters emitting undamped waves, as very sharp tuning is possible.

101. *Give dimensions of a good variometer.*

Outside core—cardboard, six inches in diameter; inside core—cardboard, five inches in diameter; both tubes or cores two inches wide. Each core is wound with one even layer of No. 24 enameled wire for a distance of ¾ inch from one end. Then a space ½ inch wide is left, continuing the wire to the other side of this space, and the balance of ¾ inch is wound with one even layer of the wire as before. About 90 feet of wire will be needed for the inner coil and 110 feet for the outer coil.

102. *What is an interference preventer?*

One type of interference preventer consists of two tuning coils, detector and two variable condensers connected as shown in Fig. 31. The tuning coils may be either both of the double slide type or both of the loose coupled type. A combination of the double slide tuner and a loose coupled tuner can also be used.

Adjustment is made to ground the energy received from the interfering station by moving the ground slide of one

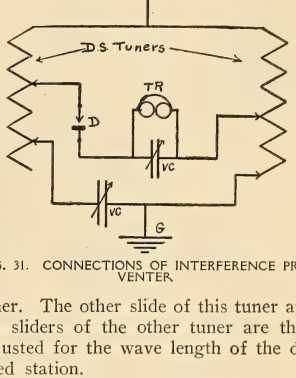


FIG. 31. CONNECTIONS OF INTERFERENCE PREVENTER

tuner. The other slide of this tuner and the sliders of the other tuner are then adjusted for the wave length of the desired station.

103. *What is a pancake tuner?*

A pancake tuner consists of two spiral windings of insulated copper ribbon which are movable with respect to each other in a manner similar to that employed in the ordinary receiving transformer. The sliding contacts are arranged to make connection with any turn of the ribbon. The action of this tuner is similar to that of the receiving transformer.

104. *What is the purpose of a helix?*

The helix is a transmitting tuning coil and is used for the same general purpose as a receiving tuning coil, to vary the wave lengths of the various circuits to which it is connected, by varying their inductances.

A helix may be of the close or loose coupled type. The former has one winding and the latter two. A close coupled helix (Fig. 32) may be either a true

helix in form or may be wound in a spiral in one plane. The former type has the advantage that every turn has the same inductance and the insulation between turns is greater. The latter helix is more compact, but the outer turns have a greater inductance than the inner ones, which is a disadvantage, especially when there are two or more circuits used.

FIG. 32. CLOSE COUPLED HELIX

The loose coupled helix finds its main application in systems emitting undamped waves, since in the ordinary systems of the present time the loss of energy due to the distance between the windings is too great for practical purposes.

105. *Give dimensions for a helix to be used with coils giving up to four inch sparks and transformers up to ½ kw. capacity.*

Diameter of winding—eight inches; number of turns—10; size of wire—No. 8; kind of wire—copper or aluminum distance between turns—1⅜ inches.

A helix for larger transformers up to two kw. may have a diameter of ten inches and be wound with No. 6 or 4 copper wire, all other dimensions remaining the same.

Directory of Wireless Clubs

This directory of amateur wireless clubs and associations will be published quarterly. When a new club is formed the names of the officers, also the street address of the secretary, should be forwarded to us at once. Any changes that should be made in the directory, when designated by an official of a club, will be made in the next issue after receipt of such advice.

Aerogram Club.—J. Stedman, President; A. Hayward Carr, Chairman Board of Directors; Albert S. Hayward, Treasurer; Donald P. Thurston, Secretary; Walter B. Clarke, 17 May St., Newport, R. I., Corresponding Secretary.

Aerograph Club of Richmond, Ind.—H. J. Trueblood, President; Richard Gatzek, Vice President; James Pardieck, 320 South 8th St., Richmond, Ind., Secretary.

Aero Wireless Club.—A. Garland, President; W. Ladley, Vice President; D. Beard, Napa, Calif., Secretary and Treasurer.

Allegheny County (Pa.) Wireless Association.—Arthur O. Davis, President; Theodore D. Richards, Vice President; James Seaman, Leetsdale, Pa., Secretary and Treasurer.

Alpha Wireless Association.—L. L. Martin, President; F. A. Schaeffer, Vice President; G. F. Girton, Box 57, Valparaiso, Ind., Secretary and Treasurer.

Amateur Wireless Association of Schenectady, N. Y.—D. F. Crawford, President; L. Beebe, Vice President; C. Wright, Treasurer; L. S. Uphoff, 122 Ave. "B," Schenectady, N. Y., Secretary.

Amateur Wireless Club of Geneva (N. Y.).—H. B. Graves, Jr., President; C. Hartman, Vice President; L. Reid, Treasurer; Benj. Merry, 148 William St., Geneva, N. Y., Secretary.

Arkansas Wireless Association.—G. A. Rauch, President; Edward Vaughn, 2622 State St., Little Rock, Ark., Secretary and Treasurer.

Berkshire Wireless Club.—Warren A. Ford, President; William Yarkee, Vice President; Charles Hodecker, Treasurer; Jas. H. Ferguson, 18 Dean St., Adams, Mass., Secretary.

Canadian Central Wireless Club.—Alexander Polson, President; Stuart Scorer, Vice President; Benj. Lazarus, P. O. Box 1115, Winnepeg, Manitoba, Can., Secretary and Treasurer.

Cardinal Wireless Club.—K. Walthers, President; F. Dannenfelser, Vice President; Miss A. Peterson, South Division High School, Milwaukee, Wis., Secretary.

Chester Hill Wireless Club.—Waller Morgan, President; Richard D. Zucker, 46 Clinton Place, Mt. Vernon, N. Y., Secretary and Treasurer.

Chicago Wireless Association.—F. V. W. ReQua, President; S. W. Wooster, Vice President; C. Stone, Treasurer; F. D. Northland, Secretary; R. P. Bradley, 418 South Wabash Ave., Chicago, Ill., Corresponding Secretary.

Coatesville Radio Telegraphy Association.—Charles Mellin, President; Ira Laird, Vice President; Raymond C. Newlin, Treasurer; Geo. H. Newlin, 326 Charles St., Coatesville, Pa., Secretary.

Colorado Wireless Association.—William Cawley, President; Thomas Ekren, Vice President; W. F. Lapham, 1545 Milwaukee St., Denver, Colo., Secretary-Treasurer.

Custer Wireless Club.—Franklin Webber, President; Fred Cross, Vice President; Oakley Ashton, Treasurer; Walter Maynes, 438 Custer Ave., Los Angeles, Cal., Secretary.

De Kalb Radio-Transmission Association.—Bruce Lundberg, President; Walter Bergendorf, Vice President; De Esten Snow, Treasurer; Bayard Clark, 205 Augusta Ave., De Kalb, Ill., Secretary.

Electro Mechanical Association of Columbus, Ohio.—Howard Meyer, President; Robert Poole, Vice President; Stephen Davis, Treasurer; John Dolby, 512 W. State St., Columbus, Ohio, Secretary.

Fargo Wireless Association.—Kenneth Hance, President; John Bathrick, Vice President; Earl C. Reineke, 518 9th St., Fargo, N. D., Secretary.

Forest Park School Wireless Club.—W. S. Robinson, Jr., President; William Crawford, R. F. D. No. 1, Springfield, Mass., Secretary.

Frontier Wireless Club.—Franklin J. Kidd, Jr., President; A. Donald Allerbury, 1034 Elmwood Ave., Buffalo, N. Y., Secretary-Treasurer.

Fruitvale Wireless Club.— Jos. C. Brewer, President; Abner Scoville, Vice President; Alwin Karner, 1612 35th St., Oakland, Calif., Secretary.

Geneva Wireless Club.—Charles B. Hartman, President; Charles Smith, Vice President; Benjamin Merry, Treasurer; Henry B. Graves, Jr., 448 Castle St., Geneva, N. Y., Secretary.

Gramercy Wireless Club.—James Platt, President; John Gebhard, Vice President; John Diehl, Treasurer; John Jordan, 219 East 23d St., New York, N. Y., Secretary.

Granby High School Electricity Club.—Harold Taylor, President; Stuart Bliss, Vice President; Eastman Smith, Granby, Mass., Secretary-Treasurer.

Greenfield Wireless Association.—Edward M. Wolfe, President and Corresponding Secretary, 4125 Haldane St., Pittsburgh, Pa.

Hannibal (Mo.) Amateur Wireless Club.—Charles A. Cruickshank, President; J. C. Rowland, Vice President; William Youse, Treasurer; G. G. Owens, 1306 Hill St., Hannibal, Mo., Secretary.

Harriman Wireless Association.—Oswald L. Fillmore, President; Everett R. Parish, 801 Clinton St., Harriman, Tenn., Secretary.

Haverhill (Mass.) Wireless Association.—Riedel G. Sprague, President; Charles Farrington, Vice President; Leon R. Westbrook, Haverhill, Mass., Secretary and Treasurer.

Hobart Wireless Association.—Asa Bullock, President; Charles Clifford, Hobart, Ind., Secretary.

Independence Wireless Association.—Boyce Miller, President; Ralph Elliott, Secretary; Joseph Mahan, 214 South Sixth St., Independence, Kan., Vice President.

Independent Wireless Transmission Co.—Harlan A. Eveleth, 72 Gray St., Arlington, Mass., Secretary.

Jonesville Wireless Association.—Frederic Wetmore, President; Webb Virmylia, Vice President; Richard Hawkins, Treasurer; Merritt Green, Lock Box 82, Jonesville, Mich., Secretary.

Killington Radio Club of Rutland, Vermont.—John L. Copps, President; Howard Crane, Vice President; W. R. Canty, Rutland, Vt., Secretary.

Lake View Wireless Club.—E. M. Fickett, President; R. Ludwig, Treasurer; R. F. Becker, 1439 Winona Ave., Chicago, Ill., Secretary.

Lane Technical High School Club.—B. C. Lizenby, President; C. I. Gringrich, Vice President; C. H. Stone, Treasurer; J. Simon, Secretary; R. R. Traub, Lane Technical High School, Chicago, Ill., Corresponding Secretary.

Lexington Aerogram Company.—Roger H. Preston, President; Francis Dean, Vice President; Charles Young, 5 Warren St., Lexington, Mass., Secretary.

Long Beach Radio Research Club.—Bernard Williams, 555 E. Seaside Bvd., Long Beach, Calif., Secretary.

Manchester, (N. H.) Radio Club.—Homer B. Lincoln, President; Clarence Campbell, Vice President; Elmer Cutts, Treasurer; Earle Freeman, 759 Pine St., Manchester, N. H., Secretary.

Minneapolis Wireless Club.—F. D. Gage, President; John L. Ewart, Minneapolis, Kans., Secretary.

New Haven Wireless Association.—Roy E. Wilmot, President; Arthur P. Seeley, Vice President; Russell O'Connor, 27 Vernon St., New Haven, Conn., Secretary and Treasurer.

New Thomson Wireless Club.—T. Frank Edwards, President; C. D. Fitzgerald, Vice President; Edward M. Fleming, care the New Thomson, Kane, Pa., Secretary.

Non-interference Wireless Association of America.—Melville S. Barr, President; Albert E. Snow, Treasurer; Gerald E. Travis, 1062 Saratoga St., East Boston, Secretary.

Northwestern Wireless Association of Chicago.—Rolf Rolfson, President; H. Kunde, Treasurer; Edw. G. Egloff, 2729 Noble Ave., Chicago, Ill., Recording Secretary.

Oakland Wireless Club.—H. Montag, President; W. L. Walker, Treasurer; W. R. Sibbert, 916 Chester St., Oakland, Calif., Secretary.

Oklahoma State Wireless Association.—T. E. Reid, President; G. O. Sutton, Vice President; Ralph Jones, Box 1448, Muskogee, Okla., Secretary and Treasurer.

Oregon State Wireless Association.—Charles Austin, President; Joyce Kelly, Recording Secretary; Edward Murray, Sergeant-at-Arms; Clarence Bischoff, Lents, Ore., Treasurer and Corresponding Secretary.

Peterboro Wireless Club.—G. B. Powell, President; C. V. Miller, Vice President; E. W. Oke, 263 Engleburn Ave., Peterboro, Ontario, Can., Secretary and Treasurer.

Plaza Wireless Club.—Paul Elliott, President; Myron Hanover, 156 E. 66th St., New York, N. Y., Secretary and Treasurer.

Pueblo Wireless Club.—L. R. Finke, President; B. C. Howe, Treasurer; K. G. Hermann, 100 Board of Trade, Pueblo, Colo., Secretary.

Radio-Signal Club of Chicago.—W. E. White, President; G. C. Schade, Vice President; F. H. McCarthy, 2113 Washington Bvd., Chicago, Ill., Secretary and Treasurer.

Rockland County Radio Wireless Association.—M. V. Bryant, President; H. I. Sprott, Treasurer; P. Haeselbarth, Nyak, N. Y., Secretary.

Roslindale (Mass.) Wireless Association.—O. Gilus, President; E. T. McKay, Treasurer; Fred C. Fruth, 962 South St., Roslindale, Mass., Secretary.

Sacramento Wireless Signal Club.—E. Racklift, President; J. Murray, Vice President; G. Banvard, Treasurer; W. E. Totten, 1524 "M" St., Sacramento, Calif., Secretary.

Santa Cruz Wireless Association.—Orville Johnson, President; Harold E. Sentor, 184 Walnut Ave., Santa Cruz, Calif., Secretary and Treasurer.

Seneca Electrical Club.—Neil A. Stillman, President; Maurice P. Whitney, Vice President; Harold Server, Treasurer; Howard Donnelly, R. F. D. 1, Geneva, N. Y., Secretary.

Southeastern Indiana Wireless Association.—R. F. D. 1, Geneva, N. Y., Secretary.

Southeastern Indiana Wireless Association.—R. F. Vanter, President; D. C. Cox, Vice President and Treasurer; H. Hitz, Fairmont, Madison, Ind., Corresponding Secretary.

Southern Wireless Association.—B. Oppenheim, President; P. Gernsbacher, 1435 Henry Clay Ave., New Orleans, La., Secretary and Treasurer.

Springfield (Mass.) Wireless Association.—A. O. Gravel, President; C. K. Seely, Vice President and Treasurer; D. W. Martenson, Secretary; Club Rooms, 323 King St., Springfield, Mass.

Spring Hill Amateur Wireless Association.—R. D. Thiery, President; H. P. Hood, 2nd, 2 Benton Road, Somerville, Mass., Secretary and Treasurer.

St. Paul Wireless Club.—E. C. Estes, President; W. P. Husby, Vice President; T. J. Taylor, Treasurer; L. R. Moore, 1911 Ashland Ave., St. Paul, Minn., Secretary.

Tri-State Wireless Association.—C. B. DeLaHunt, President; O. F. Lyons, Vice President; T. J. Daly, Treasurer; C. J. Cowan, Memphis, Tenn., Secretary.

Waterbury Wireless Association.—Arthur E. Hapeman, President; Walter Lowell, Treasurer; H. M. Rogers, Jr., 65 Elizabeth St., Waterbury, Conn., Secretary.

Wireless Association of British Columbia.—Clifford C. Watson, President; J. Arnott, Vice President; E. Kelly, Treasurer; H. J. Bothel, 300 Fourteenth Ave. E., Vancouver, B. C., Corresponding Secretary.

Wireless Association of Canada.—W. Fowler, President; E. G. Lunn, Vice President; W. C. Schuur, Secretary and Treasurer.

Wireless Association of Fort Wayne.—Adolph Rose, 1326 E. Wayne St., Fort Wayne, Ind., President and Secretary.

Wireless Association of Montana.—Roy Tysel, President; Elliot Gillie, Vice President; Harold Satter, 309 South Ohio St., Butte, Mont., Secretary.

Wireless Association of Savannah.—P. C. Bangs, President; A. A. Funk, Vice President; H. Jenkins, Treasurer; L. H. Cole, Cor. Liberty and Price Sts., Savannah, Ga., Secretary.

Wireless Club of Baltimore.—Harry Richards, President; William Pules, Vice President; Curtis Garret, Treasurer; Winters Jones, 728 Monroe St., Baltimore, Md., Secretary.

Wireless Club of the Shortridge High School.—Robert C. Schimmel, 2220 N. Penn St., Indianapolis, Ind., President; George R. Popp, Vice President; Bayard Brill, Treasurer; Oliver Hamilton, Secretary.

Y. M. C. A. Wireless Club of Williamsport, Pa.—Lewis Holtzinger, President; Christian Cupp, Vice President; Robert Templeman, Treasurer; Lester Lighton, 211 W. 4th St., Williamsport, Pa., Secretary.

Zanesville Wireless Association.—Charles S. Shryock, President; Rudolph C. Kamphausen, 105 South Seventh St., Zanesville, Ohio, Secretary-Treasurer.

For Practical Electrical Workers

Construction of a 50 Watt Dynamo

BY CHARLES F. FRAASA

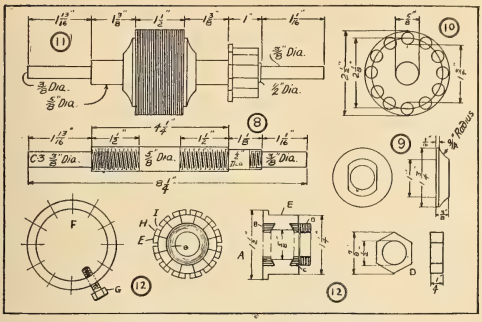
PART II.—ARMATURE, COMMUTATOR, BRUSHES, FIELD AND ARMATURE WINDINGS, ETC.

The construction of the armature and shaft, Figs. 8, 9, 10 and 11, is as follows: center an 8¼ inch piece of ⅝ inch steel rod, and turn down the ends for a distance of 2 3/16 inches from one end and 1 13/16 inches on the other end to a diameter of ½ inch. Thread the center portion for a distance of 1½ inches from each end, eleven threads per inch, as shown in Fig. 8. Then from some iron or steel, turn two pieces as dimensioned in Fig. 9. The central hole is bored ½ inch in diameter, and threaded with a ⅝ inch eleven thread tap.

Cut up enough 2¾ inch pieces of No. 27 gauge sheet steel to make a stack 1½ inches thick when compressed. Clamp them to a drill press and drill a ⅝ inch hole through the center. Put the disks on the shaft and turn on the nuts, Fig. 9. Locate the twelve equally spaced slots, Fig. 12, and center punch. These slots are drilled with a ⅜ inch drill. When the holes are drilled put some ⅜ inch dowels or iron bolts through them and mounting the shaft between the lathe centers turn down the core to 2½ inches in diameter. The slots are then cut open with a hack saw, two or three blades being mounted in the frame to secure the right width of slot opening.

While the core and shaft are still in the lathe turn down the ends of the shaft to the dimensions given in Fig. 8, and thread the ½ inch portion twelve threads per inch for the commutator lock nut. The assembled armature should then appear as in Fig. 11.

The commutator (A), Fig. 12, is composed of a number of copper segments insulated by mica and held together by the two iron rings (B) and (C) and a lock nut (D). The segments (E) are made from a copper casting, or, better, a copper forging about 1¾ inches in diameter and one inch long. The copper forging is chucked and rough turned to within 1/16 inch of the required size, and then the circumference is divided into twelve equal parts. The hole through the center should be bored to ½ inch in diameter. Mount the copper ring on a mandrel, and with a thin screw slotting tool, cut along the division marks to within 1/16 inch of cutting through. From some sheet mica, split twelve sheets as thick as the slitting saw which cut the slots in the commutator and insert them in the slots. Use a micrometer in this operation if available. If the mica is too thick scale it off to the right thickness. Each piece of mica as inserted should be dipped in shellac. Mount the commutator on the mandrel again, and turn off the projecting mica. Turn up a ring of iron (F), Fig. 12, 1¾ inches internal diameter and 2¼ inches in external diameter. Drill twelve equally spaced holes around the circumference of this ring with a No. 29 drill, and tap with a 3/16 inch



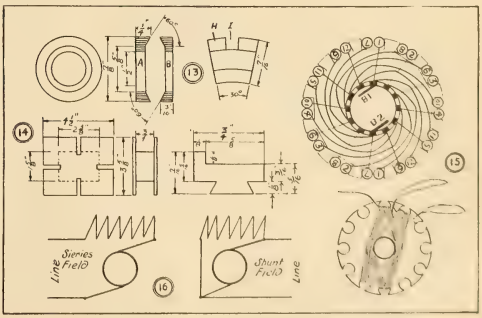
ARMATURE, SHAFT AND COMMUTATOR

24 thread tap. Into these holes screw twelve 3/16 inch screws (G), and when the commutator is dry, put the ring over it and turn the screws down tightly. The ring may then be chucked in the lathe for boring the inside and turning the ends of the commutator. After the 1/16 inch of metal remaining around the hole has been bored away, the screws should be tightened up before the boring and turning is completed.

The rings (A) and (B), Fig. 13, and the nut (D), Fig. 12, are turned from iron. The nut is bored 25/64 inch in diameter, and tapped twelve threads per inch with a ¼ inch tap.

Scale off some mica very thin and cover the surfaces of the rings (A) and (B), Fig. 13, which touch the commutator using a liberal amount of thin shellac. When they are dry, put the ring (A) on the shaft up against the shoulder, and wrap a piece of mica about ½ inch wide on the shaft, varnishing it well with shellac. Then put the commutator on and the other ring (B), and screw up the nut (C). Test the commutator for grounds with test leads connected in series with a 110 volt lamp. If a ground is found between the commutator and the shaft, the insulation is faulty and should be improved. Direct the flame of a blow pot on the commutator to bake it. The shellac will boil out and the screws and the nut should be turned up tighter. When the shellac is baked out, remove the ring and turn down the outside of the commutator. The raised ring (H), Fig. 12, around the commutator is for the connections. Twelve slots (I) about ⅛ inch deep should be cut in this ring, one in the center of each segment.

The brushes are composed of several leaves of thin spring copper or brass soldered together at one end. For the two ampere machine use two leaves of No. 24, ½ inch wide, and for the five ampere machine, four leaves. The brushes are mounted in slots cut in the brush holder studs (C), Fig. 3 (Part I.) Nut (D), Fig. 3, binds the brush in place. To vary the tension of the brushes, loosen nut (E), and rotate the stud un-



ARMATURE AND FIELD COIL WINDINGS

til the brush bears on the commutator with the proper tension and tighten up the nut (E) again. The slot in the brush holder stud should be wide enough to receive the brush. The leads to the brushes connect to the terminals (G), to which they are soldered. These terminals are placed between the two nuts (H) and (I). The end of the brush should be filed or ground to fit the curvature of the commutator. When mounting the brush holder studs, wrap a piece of 1/32 inch fiber around the stud where it goes through the hole in the brush holder, and put a fiber washer under the nuts (E) and (H).

The field coils are wound in the form, Fig. 14, and bent to the curvature of the field magnet by clamping between two blocks turned to the same curvature as the inside of the field ring. When the coil has been wound, slip a string through the four saw slots in the form and tie the coil tightly. Remove the coil from the form and dip in thin shellac and bake well in an oven, then wind a layer or two of tape over the whole coil. The terminals of each coil should be soldered to flexible lamp cord for connection leads.

The shunt windings are as follows: 25 volts two amperes, 1714 turns, 857 per pole of No. 25 d.c.c.; ten volts five amperes, 686 turns, 343 per pole of No. 21 d.c.c.

The series windings are: 25 volts two amperes, 344 turns, 172 per pole of No. 18 d.c.c.; ten volts five amperes, 138 turns, 69 per pole of No. 14 d.c.c.

Wind both coils in the same direction, and the connections will be made more convenient.

The slots and the armature will have to be insulated before winding. On each side of the armature wrap several layers of shellacked paper or muslin, for a distance of about one inch. Cut a number of disks of insulation about three inches in diameter, and glue them to the heads of the armature with thin shellac. When this dries, trim the insulation off around the periphery and from over the slot ends. Twelve pieces of 1/32 inch fiber should then be folded, and inserted in the slots. These troughs should stick out on the ends of the armature for about 1/8 inch, so that the winding will have no possible chance to be cut by the core.

The shunt armature windings are 25 volts two amperes, 72 turns No. 23 per slot, 36 per coil; ten volts five amperes, 28 turns No. 19 per slot, fourteen per coil. The series windings are: 25 volts two amperes, 90 turns of No. 24 per slot, 45 per coil; and ten volts five amperes, 36 turns per slot of No. 20, eighteen per coil, all double cotton covered magnet wire.

Fig. 15 illustrates the armature winding. Two coils are wound in each slot, making a total of twelve coils. The coils may be wound each from a separate piece of wire, but when wound this way, some confusion of ends results, making the connections to the commutator rather confusing to the beginner. A better method is to wind each slot half full and leave out a loop at the slot before winding the next coil. The coils are wound in slots diametrically opposite, coil 1 being wound in slots 1 and 7; coil 2 in slots 2 and 8; coil 3 in slots 3 and 9; coil 4 in slots 4 and 10; coil 5 in slots 5 and 11; coil 6 in slots 6 and 12; coil 7 in slots 7 and 1; coil 8 in slots 8 and 2; coil 9 in slots 9 and 3; coil 10 in slots 10 and 4; coil 11 in slots 11 and 5; coil 12 in slots 12 and 6. The slots will then be found to contain the conductors of two coils, and there will be twelve loops sticking out from the sides of the slots. Test for grounds, and apply a liberal coat of shellac. The winding must be carefully done, to get the correct number of turns in each slot. If there is any space left in the top of the slot, put a wooden strip in it to prevent the wires pulling out when the armature is running, or wedge a thin strip of fiber or wood in the saw cuts which open the slots, and shellac well.

The whole armature should then be baked.

The connections to the commutator are simple. Each loop is brought straight out from the slot to the commutator segment, and soldered in the slot provided for it.

When the armature is wound and connected, we are ready to assemble the dynamo. It will be noted that the field coils are wound large enough to go over the pole piece tips. The core should be built up with fiber or paper and wrapped with tape to the inside dimensions of the field coil. Secure a thin piece of fiber to the inside of the field ring around the core to insulate the field ring from the coil. Then slip the field coils in place and connect the end of the one coil to the end of the other. When the current flows through the field coils, it will flow in opposite directions around the poles, making one a north pole and the other a south pole.

The connections of the armature and field for series and shunt excitation are shown in Fig. 16. In the series field the total armature current flows through the field while in the shunt only a fraction of the armature current flows through the field, since it is a comparatively high resistance connected in shunt with the armature. The terminal binding posts are turned from brass and should be insulated from the field casting by a fiber bushing, and fiber washers.

An inch pulley having a one inch crowned face is recommended, though a grooved pulley and a ⅜ inch round belt may be used.

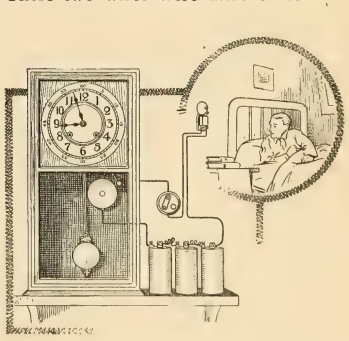
When starting the dynamo for the first time, the fields should be magnetized by a battery. The cast steel field magnet will then retain sufficient magnetism to enable it to start generating. It would be best to try it first as a motor to see if all connections are properly made. There will then be a residual magnetism in the field casting and it will not be necessary to magnetize it. If it runs as a motor, try it as a dynamo. The brushes should be somewhere between the tips of the pole pieces on opposite sides of the commutator. With a voltmeter in circuit, speed the machine up to its rated speed and shift the brushes back and forth until a position of highest voltage and least sparkling is found. This will be the running position of the brushes when running as a dynamo.

With the machine running as a dynamo the brushes are always given a little lead in the direction of rotation, but when running as a motor they should be given a little lead in the opposite direction.

To Make Bell Strike the Hours

It was necessary that I arrange to have a bell at a distance from a clock strike the hours at the same time as the clock.

The gong of the clock was connected to one wire and the hammer to another. These two wires were attached to bat-



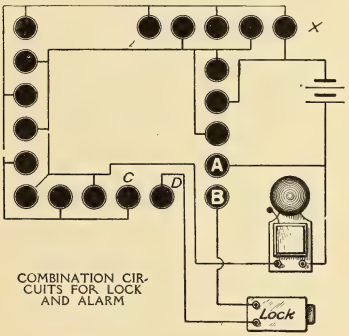
BELL THAT STRIKES THE HOURS

teries and run to the distant bell as shown. As the gong of the clock was insulated by being mounted on the wooden back, the hammer closed the circuit with each stroke. A single stroke bell is best but a vibrating bell may be used.—J. B. Wood.

Tool Chest Lock and Alarm

As a safeguard against thieving an ingenious mechanic has equipped his tool chest with a combination electric lock and alarm.

An electric door opener, such as is now employed to open doors from remote points, is fitted to the lid of the chest and



COMBINATION CIRCUITS FOR LOCK AND ALARM

serves as a lock. With this device, when bought from the dealer, is also furnished a stiff spring, designed to fit into the jamb of the door. This does the duty of forcing the door open when the electric lock, or door opener, is operated. In the present case the spring is attached to the chest and exerts an upward pressure against the lid.

On the lid of the chest the designer's initials are formed with brass upholstering nails placed about an eighth of an inch apart. These are connected—on their points on the inside of the lid—in a dry battery circuit with the lock and a bell, as shown in the illustration. A circular hole, protected by small iron bars, is made in the back of the chest near the bell, to convey the alarm more clearly. Brass hinges connect the wires where the current is carried across the lid from the battery in the chest.

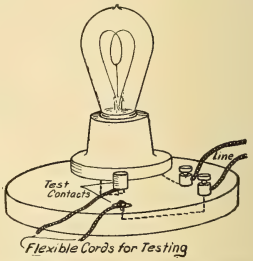
Closing points (A) and (B) and points (C) and (D) releases the lock, while the spring raises the lid automatically. But closing any other two adjacent points rings the bell. A finger ring, a key or any other metal objects handy are used to make the connections.

In the event of the battery's becoming inactive from constant use or other causes, thereby rendering the system inoperative, temporary connections to open the chest, may be made with another battery on points (A) and (X).—Chas. K. Theobald.

Ground and Short Circuit Tester

The following arrangement I use for testing motors, fixtures, flat irons, etc., for short circuits and grounds.

Referring to the illustration, fasten a receptacle, as shown, upon a common five inch fixture block, leaving space also for line and testing terminals. Connect as indicated. The "test contacts" are placed



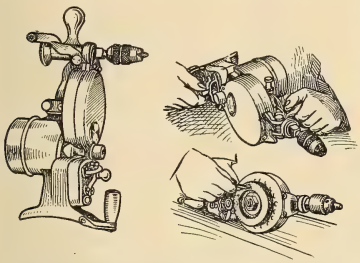
GROUND AND SHORT CIRCUIT TESTER

so that in putting the center contact of a lamp base upon one test contact, the screw shell will come in contact with the other, thus lighting both the test lamp and the lamp to be tested if the latter is in good condition. Fuses may be tested on the same contacts. In my shop I have fastened the whole outfit to a window casing and attached flexible cords to the test contacts for testing fixtures and for looking for grounds. A two candlepower lamp is sufficient in the receptacle.

E. M. Goodenough.

New Portable Electric Drill

The Temco electric hand drill satisfies the electrical engineer in that it is provided with a motor that will run on either alternating or direct current. The frame of the drill is made of aluminum, making it light to handle. Another



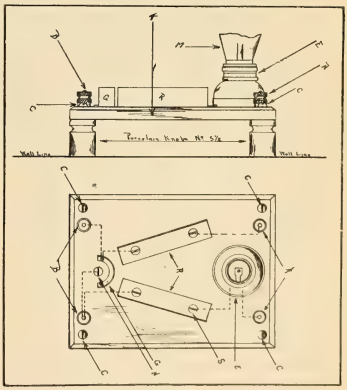
A PORTABLE DRILL WITH GRINDER ATTACHMENT

feature is that when it is desired to tighten the chuck, the drill spindle is broken over, falling into jaws on the main frame, thus preventing the spindle from turning. The drill is perfectly balanced between the handles, making it easy to hold to the work. A fourth striking innovation in its construction is the emery wheel attachment driven by the intermediate gear shaft which extends through the case. This wheel is convenient for sharpening drills.

Fuse and Trouble Tester

Considerable money is wasted by current users through good fuses being thrown away because of no place to test them to see whether they are good or not. This device also comes in handy for testing trouble in electric flat irons, curling irons, fans, small motors, etc.

The base is made from slate and is ½ by 6 by 8 inches in size. It is mounted on the wall by means of four supporting screws (C) and four porcelain knobs that keep it the right distance away from the wall. At one end is mounted the brass shell receptacle (E) to take the test lamp (M), which is an ordinary carbon filament 110 volt lamp. Two brass strips (R), made by cutting a piece of ¾ inch square casing in two pieces, are mounted on the base by means of brass machine screws. These slides are about four inches long and will test all enclosed fuses from six amperes up to 600 amperes. The small circular part (G) is made from the screw base of a socket or receptacle cut in two and mounted with brass machine screws. The center contact (H) is a brass machine screw. This part will test all sizes of plug fuses up to 30 amperes. The line is connected at the binding posts marked (A) and the wiring of the device is shown by the dotted lines. You can readily see that by placing a good fuse across the metal slides the light will burn. The lower binding posts (B) are for connecting testing terminals. These terminals can be made from two pieces of lamp cord about four feet long, with a



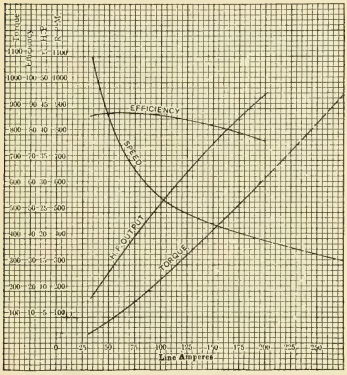
FUSE AND TROUBLE TESTER

piece of No. 14 or 12 insulated wire fastened to the end to add stiffness and to act as a handle.

The cost of making one of the testers should not exceed 75 cents.

How to Read Motor Performance Curves

Every person who owns, or ever expects to own or have charge of an electric motor should be able to read motor performance curves. These tell the whole story of the motor's capabilities and limitations at almost a glance to those who can read curves—but to the average person, and even to many engaged in electrical pursuits, a performance curve drawing looks something like a railroad map and there his information ends. Consequently



PERFORMANCE CURVES OF A MOTOR

he denies himself, many times to his disadvantage, information that might prove exceedingly valuable.

Nowadays, more than ever before, motors are sold on their "curves." It is not enough to simply say a motor has 25 horsepower capacity, because a 25 horsepower motor might mean several things. For instance, it can mean that the motor's momentary maximum output is 25 horsepower; or that its output is 25 horsepower at rated voltage for one-half hour, or maybe for one or two hours or continuously. It is true that electrical associations have laid down rules, but each motor manufacturer, nevertheless, rates motors according to his own ideas.

The result is that electrical engineers and all experienced motor buyers now demand curves showing the actual performance of the motor under all conditions of service. A motor performance curve drawing shows the exact output in horsepower for all speeds, the amount of current or amperes it consumes for any horsepower or speed within its capacity, the torque or turning power developed, and the efficiency, under all conditions.

The curves here shown give the performance of a direct current motor rated by its manufacturer at 20 horsepower. Each curve on the drawing is read between the ampere scale across the bottom, and its own scale along the side. In the drawing, "Torque" means pounds pull exerted at one foot radius (from the shaft); "H.P." means horsepower; "R.P.M." means revolutions of the shaft per minute; "Efficiency" means per cent of current or amperes converted into useful work.

To find the operating characteristics of this motor, locate the point where, at its normal rating, 20 horsepower, the "H.P. Output" curve intersects the 20 H.P. horizontal line. This point, it is seen, is on the 75 ampere vertical line (scale across bottom of drawing); at 20 horsepower then, the motor takes 75 amperes of current. The other characteristics are indicated by the different curves at the points where they intersect the 75 ampere line. Thus, by following the 75 ampere line down to the "Torque" line, it is seen by referring to the side scale, that the torque developed is 160 pounds; similarly its "Speed" is found to be 660 r. p. m. and its "Efficiency" a trifle over 88 per cent.

Now as another example assume that it is desired to know the conditions if this same motor was put to 25 horsepower service. By the same method we see that to do this extra work, it will consume 93 amperes; develops 220 pounds of torque, but the speed is reduced to 580 r. p. m., and the efficiency is now under 88 per cent.

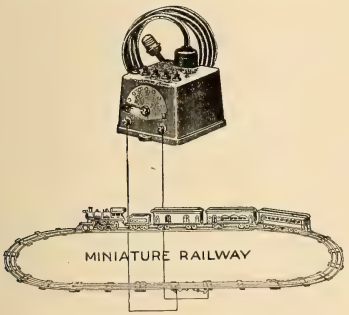
The drawing shows that this motor can develop as high as 49 horsepower (end of "H.P. Output" curve), but this is inadvisable, for while the torque is then over 600 pounds, the speed is only 420 r. p. m., and the efficiency drops way down to 78 per cent.

The rated output of the motor is, therefore, somewhat arbitrary. Any high grade motor has considerable range of power to take care of overloads. The momentary overload capacity should be about three times the rated capacity, so it is of great importance to know just what the motor can stand and what change will result in the speed, and how the overload affects the torque, the efficiency, and the current taken from the supply circuit.

By following this explanation, the performance curve of any motor can be intelligently read by anyone.

Variable Low Voltage Transformer

The transformer that will give low voltages from a 110 volt circuit finds a wide service in ringing electric bells, operating electric toys, running small motors, etc.,

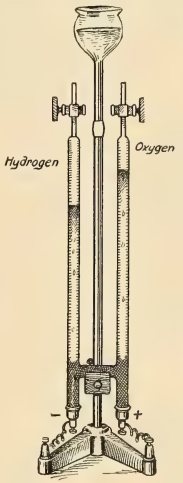


ONE OF THE USES OF THE LOW VOLTAGE TRANSFORMER

and at the same time takes so little current that it is hardly noticeable on the wattmeter. The accompanying illustration shows a Goettman transformer which is provided with a regulation switch by which voltages from seven to twelve may be obtained in one-volt steps by moving the switch from one contact point to the next. Transformers of this type are also made having a range from 2½ volts to 28½ volts.

Electrolysis of Water

Water may be separated into the two gases oxygen and hydrogen by the application of electricity. Laboratory apparatus for this purpose is here shown, although much more crude apparatus of glass is sometimes used. A heavy metal base supports the glass tubing.



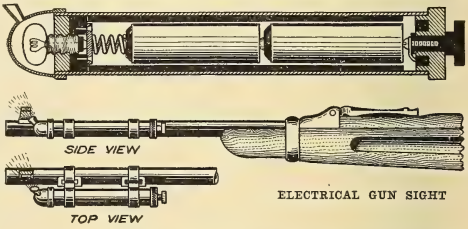
APPARATUS FOR WATER ELECTROLYSIS

When current is applied the positive terminal gives off oxygen while the negative terminal gives off hydrogen. The volume of the gases are in the proportion of two of hydrogen to one of oxygen, which corresponds to the chemical symbol for water, H_2O. At the top of each tube a valve for releasing the gas is provided. A rubber tube may be attached to the end of either tube and led into a test tube filled with water and inverted in a dish of water and gas collected for testing.

Water made slightly acid with sulphuric acid decomposes with the application of three volts. Careful experiments show that pure water really begins to separate into its gases at 1.08 volts. One ampere hour will free 12.8 cubic inches of oxygen and 16.3 cubic inches of hydrogen.

An Illuminated Gun Sight

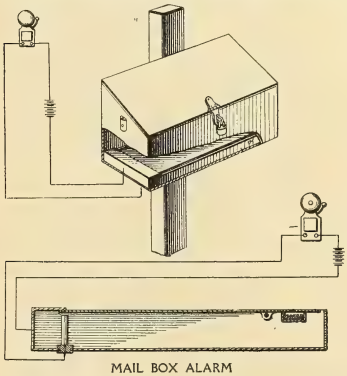
For the aid of hunters shooting in the dark, an electric lamp and battery have been so designed as to permit their being strapped to the gun barrel as shown. Light is projected upon the gun sight by a funnel shaped cover for the lamp so that the light is carefully screened from the object shot at. It is claimed that if the outline of the animal can be discovered, accurate shooting can be done with the illuminated sight.



ELECTRICAL GUN SIGHT

Mail Box Alarm

Monroe W. Grindle, of Santa Rosa, Cal., may doze in his chair or finish the milking and yet be notified the moment the rural mail carrier drops a letter or paper into the mail box. The device upon which he has secured a patent consists of a tilting bottom in the box in the form of a lever slightly weighted at one end and provided with an electric contact under the other. A postal card dropped into the box will cause the tilting bottom to swing down and close the bell circuit.


MAIL BOX ALARM

An Ingenious Safety Device

In these days of complicated mechanical apparatus designed to further comfort and to protect property, it is interesting to know that one electrical expert at least has reached the conclusion that to accomplish to a great extent the protection mentioned, the simplest means are the best.

As a protection against burglary, fire and flood, an electrical engineer in New York has devised a simple contrivance consisting of four screws, two strips of brass, a screw-eye, and a piece of cotton or string, applied to a hallway, window, etc., with the necessary wires and battery. The operation of this apparatus is as follows:

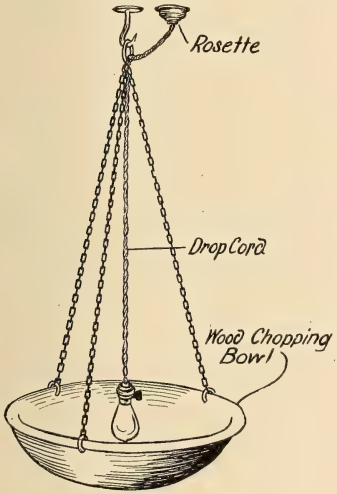
First tie the cotton securely to the screw-eye, draw taut across the opening to be protected, and attach it to the spring hook in such a manner that the cotton holds the spring away from the back screw and the front strip of brass. Then turn on the switch and thereby connect the necessary electrical apparatus to the spring circuit.

If a burglar should enter, he presses against the cotton and draws the spring against the front contact, sending in his own alarm. If a water pipe should burst, the cotton becomes wet and shrinks, pulling over the contact and making an alarm. In case of fire, even in its incipient stages, the cotton is consumed. The spring then falls back to its original position and makes contact with the back screw, which is also connected with the electrical circuit.

The system may be somewhat elaborated so that it will give separate alarms for fire or burglar or flood by arranging the spring to work as the armature of a two-point relay. Further, the scheme is applicable either to closed or open circuits.

Chopping Bowl Reflector

Enamel the inside surface of an ordinary chopping bowl white and make the outside to harmonize with the decorations of the room in which it is to be used. For suspension, chains of whatever design is desired may be fastened at three

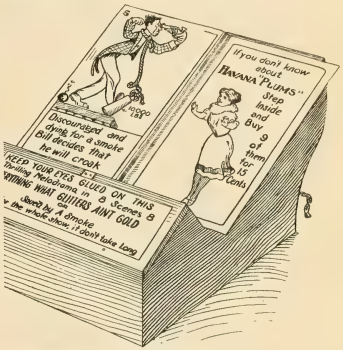


CHOPPING BOWL REFLECTOR

equidistant parts of the rim, as shown, and the free ends connected to a large ring which also serves as a ceiling fastener. A large hook screwed into the ceiling near the drop light completes the outfit. The drop light hangs vertically in the center of the chains and the cord is long enough to allow it to be screened from view by the sides of the bowl.—H. G. Wilson.

Book of Mystery

This is the name of a window advertising attraction. The device consists of a multiple card arrangement built in book form and having 22 pages, 8½ by 14 inches. The leaves are turned automat-

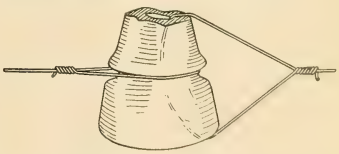


MULTIPLE CARD ARRANGEMENT BUILT IN BOOK FORM

ically and slowly enough so that each page may be read. An electric motor concealed in the oak cabinet furnishes the power.

Emergency Strain Insulator

One of the chief requirements of a "trouble shooter" on line work is that he be ingenious enough to get along with whatever material may be most conven-



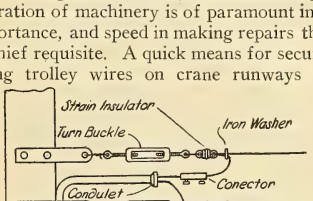
EMERGENCY STRAIN INSULATOR

ient when quick repair work is necessary. An instance of this kind happened a short time ago, in which strain insulators were necessary to finish the job. As there were plenty of glass petticoat insulators but no strain insulators to be had, it was a simple matter, when thought of, to knock

the top off a glass insulator, thus allowing the pin hole to extend all the way through. This afforded a very satisfactory substitute for a strain insulator.—H. G. Wilson.

A Trolley Wire Fastener

In large steel mills the continuous operation of machinery is of paramount importance, and speed in making repairs the chief requisite. A quick means for securing trolley wires on crane runways is

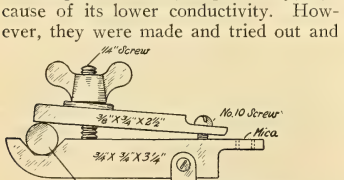


TROLLEY WIRE FASTENER.

shown. An iron washer of proper size is placed upon the wire before the wire is passed through the eye of the strain insulator. The free end of the wire is then returned through the washer and the end bent back on itself. The feed wires are then fastened by connectors, the whole operation requiring but a small amount of time.

Improved Carbon Holder for Moving Picture Machine

A picture machine operator requested me to make him some carbon holders more durable than the ones of cast brass. I suggested cold rolled steel, though doubting its worth (comparatively) because of its lower conductivity. However, they were made and tried out and



CARBON HOLDER.

were found to take no more current than the brass ones and instead of lasting three weeks they are evidently permanent, as the high heat has little or no effect on them and at that heat they are not brittle as is brass. The dimensions are all given on the drawing. Also an improved terminal is shown which carries the point of connection outside of the machine where it is easy to work while the arc is burning.—D. A. Hampson.

Removal of Oil from Condenser Water

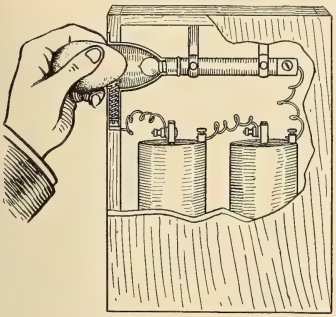
The condenser water from reciprocating engines when jet condensers are used contains some of the oil used in lubrication of the cylinders. This water is generally used again for steaming and the oil in it causes serious boiler troubles especially in the water tube type of boilers. With moderate lubrication this oil may amount to five grains per gallon.

Filtration and settling will not remove it because the oil and water form a very stable emulsion. One sample observed stood for three years with no sign of settling. All the known methods for removal of this oil make use of the fact that metallic hydroxides entangle or cover these tiny globules in such a way that they coagulate and settle out. Filtration will remove this coagulum. One method is to add aluminum sulphate and caustic soda which produces aluminum hydroxide, an insoluble compound capable of coagulating the oil drops.

The electric method, however, is simpler. The condenser water is passed through a long cell containing a large number of pairs of iron electrodes, between which the water is electrolyzed. Hydroxide of iron is formed at the anodes, and it promptly drags down with it all the oil globules in an insoluble mass which is then easily filtered off. The oil particles move with the electric current by attraction and this also helps in removing them from the water.—Harry N. Holmes.

Portable Egg Tester

A small electric flash lamp contained in a reflector is the basis of a patent recently issued to William D. Bixler of Fort Worth, Tex., upon a portable egg tester made as shown in the illustration. An

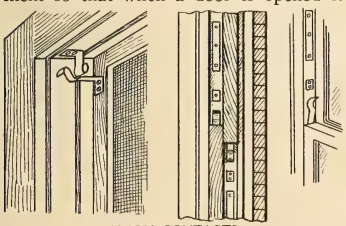


PORTABLE EGG TESTER

egg is lightly crowded into the opening of the reflector and this action closes a spring contact that completes the circuit of the lamp and two dry cells which furnish the current. The reflector causes a strong illumination of the egg's interior which decides its future.

Door and Window Alarm Contacts

It is often desirable to have an arrangement so that when a door is opened it

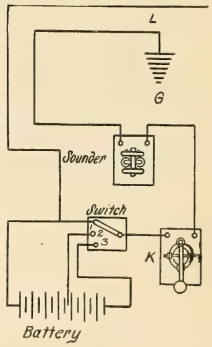


ALARM CONTACTS

will ring a bell at some convenient point. With brass strips bent and attached to the casing and screen door as shown, good and workable contacts are formed. I adapted the same idea to windows, the arrangement of the brass strips being shown in the illustration. Through the short contact point the bell will ring when the window is raised a little from the bottom or lowered slightly from the top. The second or long strip may be spaced any distance from the short one, this distance being governed by how much, after the first alarm, it is desired to raise the window without ringing the bell again. Two dry cells are sufficient.—W. Hall Moss.

Open Circuit Telegraph Line

The arrangement here shown I have found to save batteries in service on a telegraph line. Place the movable contact of the switch on point No. 1 when the instruments are not in use. The batteries are then out of circuit and the sounder is connected to line and ground so that the other station may call. When both stations are working place the switch contact on point No. 2, thus assisting the other station with only part of the battery. When calling use point No. 3; that is, all the battery.—W. Hall Moss.



OPEN CIRCUIT TELEGRAPH

Knife Blade as Eye Magnet

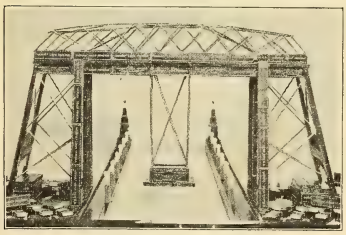
Unscrew the cap and remove the diaphragm of an ordinary telephone receiver. Gently stroke the knife blade on one of the magnets of the receiver (be sure to use the same pole all the time). I have used a blade so magnetized to remove particles of iron and steel from the eye.—Milton H. Shoenberg.

ELECTRICITY THE SILENT SALESMAN

Some Helpful Hints on the use of Electric Current in getting up Show Window Displays The following schemes have all been used with remarkable success

The Aerial Bridge in Miniature

One of the most unique features of Duluth scenery, and one of which the city is very proud, is the aerial bridge that stands astride the government canal. It is a ferry bridge and consists of a platform, called the "car," suspended at the end of long girders, which is made by electric power to travel along the



MINIATURE AERIAL BRIDGE

tracks raised high over the water. This platform, though it looks small in comparison with the structure as a whole, will carry four teams and over 100 passengers at once. It is said to be the only thing of the kind in America, and the only one abroad is in France.

A firm of Duluth stationers specialize in a pencil made particularly for them, named "Aerial Lead Pencil." From these pencils and their boxes they have constructed an extremely clever window display, "The Aerial Bridge in Miniature."

The frame of the bridge and the canal piers are made of "Aerial" boxes; so is the car. The girders and stringers are of the pencils. The lamps stand along the piers and the two lighthouses at the ends are bunches of pencils, each group being surmounted by a tiny electric light globe. The globes on the pier lamps are white, those on the lighthouses are red, and at night all are shining brightly.

The miniature car is moved by means of a cord that passes round and round through the two rows of boxes spanning the canal; the cord is equipped with a mechanical device which will catch the car at one side of the canal, carry it slowly along and release it at the other side. The car stops for a moment, then it is caught again and slowly carried back across the canal. The cables which pass from the wheels at the sides of the car to the cord above are in imitation of the ones on the real bridge; they revolve slowly while the car is in motion, but have nothing to do with the progress of the car. The power is supplied by a small motor in the basement.

The background is a great sheet of stiff paper, curved toward the back of the window. It is painted in water colors to represent distant lake and sky. Far out on the lake can be seen boats, full steam on. The water in the canal and about the piers is of the paper.

Electric Advertising in Clock Case

An attractive method of displaying advertising is the device of a Los Angeles inventor. It is in the form of a handsome clock in a tall case, the upper portion of which contains the timekeeper, while the lower part holds the mechanism which displays illuminated photographs on glass slides. Both the lighting and the mechanical operation are electric. A motor of 1/20 horsepower runs the mechanism at a cost of about five cents a day. It contains four Mazda lamps, one behind each of the four photos displayed at a time, and one behind the dial.

By an ingenious device, the 60 plates which it contains are shifted at ten second

intervals in the front of the case. The upper plate moves back, the three others move up and a fourth fills the lower space. This gives a total display of 40 seconds to each plate.

Only high class advertising is accepted by the holders of this patent, such as accurately colored photos with a few

INSIDE AND OUTSIDE OF AN ADVERTISING CLOCK

words of text, as the object is to make the scenic clock so attractive that it will be welcome in the lobby of a first class hotel or other public building.

"Save a Dollar" Window

Demonstrate to the average person how he can save money and you have his interest, especially if the demonstration is made with real money.

This side of human nature is made use of by a shoe store in a window display. "Save a dollar" is the slogan used and this is emphasized by a safe set in the window into which from a supporting cabinet below passes a belt made of one

A NEVER ENDING STREAM OF MONEY

dollar bills. A pile of paper money is also placed in the window. A concealed electric motor moves the apparently never ending stream of money and the window is a center of attraction.

Advertisement on Lamp Globe

A large translucent glass globe containing an incandescent electric lamp and having on its exterior an advertisement is being widely used in show windows.

LAMP GLOBE ADVERTISEMENT

Besides presenting the advertisement in a way that cannot be disregarded, the globe fills the window with a subdued light.

Hat Cleaner's Advertisement

In a western city a thrifty hat cleaner draws the attention of the passing crowd to his small but efficient establishment by whirling a couple of hats on the outside of his display window, as shown in the drawing. Auxiliary shafts and belting

HAT CLEANER'S ADVERTISEMENT

reach these from the rotary polishing block he is at work upon, and the energy used in rotating them is almost nil, not to mention the fact that a further saving is made by operating them simultaneously with the polishing block. The ever ready electric motor attends to the trick.

Fly Chaser for the Baker's Window

The baker's show window is usually an interesting one, but during the summer months much of its attractiveness is lost by the necessary protection of the goods from flies by wire screening. To overcome this, one manufacturer of good things placed an oscillating fan high up in the window corner, and fastened long streamers of brightly colored cloth above it. As the fluctuating breeze caught the streamers it alternately lowered and raised them over the goods, and, as it

FLY CHASER OPERATED BY A FAN

were, pointed long fingers to the protected eatables as well as served as an additional protection against flies.

The Anti-Window-Steamer

Storekeepers fully realize how detrimental a steamy window is to their trade. Passers-by do not see the goods displayed, so that naturally they do not stop, and many chances for sales are lost in this way.

A convenient little device is being used in London and other places to prevent this, and is known as the anti-window-steamer. It consists of a small electric motor and air blower, which forces through a suitable flat nozzle, which may be ornamental in design, a current of cold air over the whole surface of the window so that it is impossible for any moisture to settle on the glass. This prevents a mist or what is commonly known as "sweating."

Blower and tube can be kept quite out of sight and only the small nozzle lies near the window. Another point is that damp air does not settle upon the goods themselves, which would often spoil them in time.

Electro-Chemistry and Promises it Holds Forth

BY DANIEL M. GROSH

Discoveries and advancements in chemistry during the past decade have been greatly dependent upon and assisted by the science of electricity, without the aid of which those industries dependent upon the higher temperatures would have been unable to reach their present state of perfection. Among the industries so developed by the electrical furnace may be mentioned the manufacture of calcium carbide, artificial graphite, carborundum, the extraction of aluminum and other refractory metals, the manufacture of phosphorus, artificial precious gems, and many others, aside from those sub-industries dependent upon the above products. Those industries such as the extraction and fixation of nitrogen are really more dependent upon the electrical end of the proposition than upon the chemical end, especially when exploited commercially.

The important part taken by the professions of both electricity and chemistry in the many industries, so far created by either or both, is but an iota compared to the demands that will be made upon the new profession of electro-chemistry, and the great work of the future is already cut out for the electro-chemical engineer, not only in the way of new discoveries and the building up of new industries, but also in the elimination of waste, conservation of energy, utilization of by-products, economy of resources and reduction of cost of production.

The next few years will see every so-called waste product turned into a source of revenue, and the waste from saw mills, paper mills, furnaces, mines, refineries and factories, which formerly taxed the owners by their accumulation and littered the face of nature, will have passed into the pockets of the owners by the genius of the electro-chemist.

The electrical furnace is responsible for the electro-metallurgical developments and the use of the current as a source of heat has in itself, apart from any other action of the electrical current, produced most amazing results. For the exploitation of the electrical furnace the world is indebted chiefly to Prof. Moissan though even before the beginning of his great work, other investigators had done much; it is his 200 contributions of new substances and methods that constitute the bulk of electro-chemical knowledge. He was the first to realize that the arc light could be used for other purposes than that of heating all out doors, and the temperature so produced of 3500° C. is limited to this point only because it is the boiling point of the carbon electrodes, and out of its withering heat the new industries and the new chemistry has arisen.

Moissan and his methods have demonstrated that nearly every metal has its carbide, though calcium carbide is the most familar to all. For illustration we will take aluminum carbide, made by heating kaolin and carbon. It leaves the furnace a mass of beautiful yellow crystals which are to all intents useless. After years it was found that this Al_4C_3, being heated with aluminum oxide, yields the pure aluminum and carbonic acid, and this meant a new method of extraction of great value. Again, another peculiarity of aluminum carbide is its slow reaction with water to produce methane or marsh gas. Now natural gas is almost methane and its origin has always been a mystery. It seems possible, however, that the abundance of aluminum compounds in the earth, with the consequent high temperature and pressure, might result in aluminum carbide and its decomposition by water into natural gas. Again, some carbides yield petroleum on treatment with water. These instances show some of the possibilities waiting the electro-chemist to de-

velop. The other carbides may also be found to yield possibilities equal to those of aluminum carbide, so long discarded.

The opportunities of the investigator evolving new industries and new utilities by means of the rarer earths is most promising, as even until a few years ago many of the rarer earths were positively unknown to the chemist except by name. The few that have been used so far have created new industries, while a wondrous field of activity remains in those not at present utilized.

Many processes now conducted by the use of chemicals alone may be improved and revolutionized by the application of the electrical element. The possibilities of printing direct from type or plates, without the use of press or ink, by the use of chemicals and electricity, is very likely to be developed commercially, as well as a new photographic art analogous to positive printing direct without the use of a negative. The mercerizing of cotton may be improved by an electro-chemical process, as well as a combined process for treating cotton in order to make it take dyes without the injurious use of mordants. Why could not an electro-chemical process be invented for making and purifying wood pulp, instead of the purely chemical process in which half of the wood is wasted in securing the pulp? An electro-chemical process of procuring the flax fibers could be invented to take the place of the one that has been used since flax was first planted, which consists in soaking the fibers in stagnant water until they rot apart. These are but a few opportunities out of the hundreds that exist in the field of cellulose alone, any one of which means a fortune.

Certain chemicals will be found to have new properties, now unknown and unsuspected, when they are experimented with electrically, as is exemplified in the X-ray and mercury vapor light. The great achievements have been made in the past by using electricity as the energy or the helper, and when the investigator reverses the process, it will be found that the results will be so marvelous and astounding that any idea the imagination might conceive as a prophecy will perhaps turn out feasible.

May it not be proven that the reason that silver and lead or copper and gold are always found together is that there is an electro-chemical disintegration and synthesis from the baser to the more precious metal, assisted by or combined with radio-activity. The furnace has created such marvelous products that even disintegration of the elements does not seem improbable or impossible.

The examples of physical and chemical catalysis even without the aid of electricity per se, or as a means of energy or power, show that untold treasures lie beneath the sod of this field. Truthfully, we do not know the cause of this mysterious influence which a catalyzing agent exerts, but great industries are the result and greater ones are awaiting the investigator.

Every industry has its door open and each new industry started creates new conditions that must be provided for and studied by trained men, and for each individual plant or factory the laboratory will be the prime requisite. There are many vitally important problems to be solved which can only be done by the trained expert.

Windows Artificially Lighted

A western moving picture house has produced a very pretty effect in its auditorium. There are windows which appear to be exposed to daylight but are artificially lighted. There are buildings adjoining the theater which would shut out the daylight and the apparent windows are simply boxes covered with colored window glass. Back of these windows are small incandescent lamps in the outer frame of the case. The lamps give the window the effect of outdoor light and greatly add to the appearance of the room when lighted between performances. This idea may be used in stores which are always dark.

Electrical Securities

BY "CONTANGO"

It would seem a good idea at the beginning of the year to draw attention to certain selected electrical undertakings, giving some particulars as to their location, operating area, ownership or connections, capital stock and securities outstanding. The facts presented will not necessarily be the same as to each example, but given rather with a view to bringing out different aspects. In no sense will any special recommendation be made, other than what may be gathered from applying the explanations and principles laid down in former articles.

It must not be forgotten that the really important points are the character of the management and the identity of the interests with which this or that particular company is connected. Where possible the system or chain of companies of which any of those mentioned may be a part will be indicated. It will also be made perfectly clear that in the majority of cases the parent or controlling company will probably furnish the best opportunity. Thus to show a system of control, take the American Light and Traction Company of New York; this company controls the Detroit City Gas Co., Detroit, Mich.; the Western Gas Co., New York; Grand Rapids Gas Light Co., Grand Rapids, Mich.; Madison Gas and Electric Co., Madison, Wis.; St. Joseph Gas Co., St. Joseph, Mo.; Southern Light and Traction Co., Jersey City, N. J.; St. Paul Gas Light Co., St. Paul, Minn.; Binghamton Gas Works, Binghampton, N. Y.; Consolidated Gas Company of N. J., Long Branch, N. J.; Muskegon Traction and Lighting Co., Muskegon, Mich., and the St. Croix Power Company of Somerset, Wis. The common stock of this parent company is very valuable and is not mentioned here as a present opportunity for purchase, as will be presently explained, but more to illustrate very forcibly the great opportunity presented to the original subscribers to the stock, an opportunity which may be equaled any year and which knocks to-day at the door of those interested in the better class of electrical securities.

It may be stated at once that the common stock of the American Light and Traction Company has been selling, during the latter part of 1912, at prices ranging from 430 to 435. As a matter of fact the price of the stock has advanced over 150 points during 1912 in spite of the fact that, at the beginning of the year before that the company voluntarily reduced rates in the most important territory in which it operates.

Now it is not suggested that there is any opportunity in buying the stock of this company at the present price, but it is suggested that it gives a brilliant example of the success attained by a well managed holding company, and that in the further examples given in the following pages will be found opportunities for purchasing stock of other holding companies at a low figure where in due course and indeed comparative short order results are likely to be equally good. Examples even of prospective share subscription opportunities will be given and the chances indicated.

But apart from purchase of stock the actual securities or bonds as you have been instructed to call them, of the American Light and Traction Company are to be bought from time to time at a comparatively low figure and are "just as good" to the purchaser, in so far as the security behind them is concerned, as a government bond, with a far higher rate of interest and therefore much better income to the purchaser.

To further illustrate this point only from another aspect, that of a lower price with a seemingly assured future wherein opportunity by immediate purchase may

be found, let the case of the Cities Service Company be mentioned. This undertaking, really part of the well known Henry L. Doherty system, operating and financing engineers, controls the Spokane Gas and Fuel Co., Spokane, Wash.; the Denver Gas and Electric Company, Denver, Col., and the Empire District Electric Co., Joplin and Carthage, Mo. The company has an authorized capital of $50,000,000 of which there is outstanding $13,669,475. The report of the Company for the year ended August 31, 1912, shows gross earnings of $1,132,528 and net of $1,053,225. In that period the company paid $579,251 in preferred stock dividends and $194,739 on the common stock outstanding, leaving a surplus of $299,235. This added to the previous surplus made a total surplus of $481,277. The year's earnings that might be applied to payments on the common stock after both dividends were paid were equal to 8.89 per cent. The common stock on which four per cent is paid at the present time sold up to 122 per share during 1912. It may be stated that the substantial reason for the premium on the par shares of that stock rests in the belief that there will be extra dividends over and above those that have been definitely agreed upon for the ensuing year.

Or again, take the example of H. M. Byllesby and company property—the Standard Gas and Electric Company—controlling seventeen companies mainly in Arkansas, California, Colorado, Minnesota, Oklahoma, Washington and Oregon. July 31, 1912, the number of gas consumers served by this company was 105,232 with 104,372 electric customers. The common stock authorized amounts to $15,000,000 with $9,343,150 outstanding par value $50. The preferred stock authorized is $30,000,000 with $10,977,950 outstanding, par value of $50. The preferred stock pays dividends at the rate of eight per cent quarterly. The amount of bonds authorized is $30,000,000 of which $10,300,000 is outstanding. The following exhibit of the Company as of August 31, 1912, is of decided interest.

Common Stock	$ 9,343,150
Preferred Stock	10,977,950
Bonds	10,300,000

The actual earnings and expenses for the twelve months ended August 31, 1912, are reported as follows:

Gross Earnings	$2,113,432.28
Expenses and Taxes	34,503.88
Net Earnings	$2,078,928.40

Calculating annual dividends and interest deductions based on the total bonds and preferred stock outstanding as shown above, the results would appear as follows:

Net Earnings	$2,078,928.40
Annual Interest on Bonds.	618,000.00
Net Profits	1,460,928.40
Annual Dividends on Preferred	878,236.00
Balance	$582,692.40

However, as the total preferred stock and bonds now issued were not all outstanding for that full period, the actual deductions for interest and dividends were considerably less, therefore, the actual balance applicable to common stock dividends was in reality larger, being $786,722.17. The total accumulated surplus August 31, 1912, was $1,079,532.35.

This shows the condition of a really standard organization whose securities may be had at a reasonable figure and doubtless will show good future profit to investors.

Or take the case of a company just being formed, the securities of which will be offered to the public this year: The Appalachian Power Company. This company was organized under the laws of Virginia in May, 1911, for the purpose of developing the water power of the New River and distributing it by

electrical transmission to southern Virginia and southern West Virginia.

The company has acquired the electrical properties, including electric lighting, railway and power systems in the towns of Bluefield, Pocahontas, Bramwell, Welch, Keystone, Pulaski, Wytheville and Marion; all within 60 miles of the development on New River; also five separate power sites on New River in Carroll and Pulaski Counties, Virginia aggregating a total fall of 225 feet, capable of developing a total of 75,000 horsepower.

The Appalachian Power Company first mortgage five per cent sinking fund gold bonds are secured by a first mortgage upon all of the property and franchises now owned or hereafter to be acquired. The estimated earnings from the utilities operated and the present closed contracts are in excess of $500,000. The estimated earnings for the year as of January 1, 1915, are as follows:

Gross Earnings	$750,000
Operating Expenses	239,000
Net Earnings	$511,000
Annual Charges:	
Interest on $5,450,000 of bonds at five per cent	272,500
Balance	$238,500

The net earnings are almost twice the bond interest charges.

Having thus given illustrations of various forms of electrical undertakings it is the intention next month to give a list of selected companies with very brief but pertinent details in regard to them.

Bonds—the Ideal Investment

In the old common law sense of the word a bond signified an obligation to perform an act and in the event of the failure to do so, there was provision for the forfeit of something or property to compensate for the subsequent damage. This is true of investment bonds, which are secured by a lien against the property which would be forfeited in case the obligations were not met. The return of the principal sum at a definite date and the regular payment of interest at a fixed rate are set forth in special agreements in the bond, which also usually provides penalties in case the agreements are not carried out.

An ideal investment must have the quality of convertibility. That is to say, it should be of such character and in such form as to permit of ready sale for cash if this is desired, or to be used as collateral for a loan at a bank in case the investor needs to borrow money quickly.

In this time of public improvements and general business projects on a huge scale requiring very large sums of capital, money is borrowed for such projects in large amounts. At the same time, in order that these loans may be available to all owners of money, large and small, a big loan or bond issue is divided into smaller parts and one of these parts is known as a bond. For example: an issue for one million dollars may be divided into one thousand parts, or bonds of $1,000 denomination each; or perhaps 2,000 bonds of $500 each, or even and better still 10,000 bonds of $100 each.

Coupons are the small ticket-like divisions attached to a bond. The reading matter on such coupons states that so many dollars of interest on the bond for year or half-year or quarter-year will be due on a certain date and will be paid at the place mentioned. When these coupons fall due, the owner of the bond clips them off and presents them for payment. If he is at some distance from the place mentioned he may collect his interest by mail, or deposit the coupons in his bank for collection. Some bonds do not have coupons; these are known as fully registered bonds. Instead of presenting coupons for collection the owner of the bonds receives his interest by check without any action on his part. To register a bond the purchaser has it sent to the agent of the maker of the bond so that

he may be recorded as its owner. Bonds may be registered in two ways. In the case of a fully registered bond both principal and interest are payable only to the person who has been recorded as its owner. Thus a "fully registered bond" may be said to be "registered as to principal and interest." When a bond is registered "as to principal only" it carries interest coupons which are collected in the usual way.

On the face of a bond there is printed the date it will fall due, or be paid off. This date is its maturity.

The rate of interest to be paid is stated in the bond, and also the time when the interest will fall due, whether every three months, every six months or yearly. This rate is paid until the bond matures or is redeemed under its optional provision. The usual interest payment is semi-annual; thus the owner of a bond bearing five per cent interest payable semi-annually, January 1 and July 1 will receive on each of those dates a half-year's interest on his bond; if the denomination of the bond is $1,000, that is face value, he will receive $25 on January 1 and $25 on July 1.

The price of a bond means the amount for which it is sold, and like the price of any commodity depends upon market conditions existing at the time. Naturally other things being equal, a five per cent bond will bring a higher price than a four per cent. But if the security behind the four per cent be considered much greater than that behind the five then the four per cent bond's price may be higher.

To quote a prominent authority—an official of one of the best known bond houses in the country—"When a man wishes to avoid risk in his investment he has in mind three important requisites:

"First: Security, or the safety of the principal invested.

"Second: Ready convertibility into cash in case a change of investment be desired, or ready money needed.

"Third: As high a rate of interest as can be obtained without sacrificing either steadiness of income or safety of principal."

The bond of the well managed and progressive electrical undertakings furnishes all three requisites and in the growing market of the day gives ample security for necessary loans.

SCIENCE EXTRACTS FROM FOREIGN JOURNALS

6,500 Telephones in Pekin.—The use of the telephone at Pekin is an instance of the way in which China is entering the field of progress. Persons who were acquainted with this country 20 years ago, and still more, those who traveled there half a century ago, will be no doubt surprised to learn that the telephone is now being used to a considerable extent at Pekin. The government is building telephone exchanges on the latest principles and there are already upward of 6,500 subscribers listed. Of these, about 3,000 are in the Chinese and the Tartar quarters.—*Cosmos, Paris.*

The Time Signals of Greenwich.—The Greenwich Observatory is now receiving wireless time signals from the continent, now that it has installed an aerial and a receiving apparatus and such signals are now regularly recorded by instruments morning and evening, which is a new departure for Greenwich, as hitherto in these matters it has found it more usual to give than to receive. At 10:44 a. m. a series of Morse V's is heard as the warning calls from the Eiffel Tower and lasts with a series of T's for 55 seconds. Then at a quarter to eleven, the first "time signal" comes. Silence for one minute; then more warning calls, and the Eiffel clock strikes 10:47 a. m. It finishes with 10:49 a. m., and the mean of these time signals is the adopted time. These, however, are not the only signals from the continent, and there is another series received from the Norddeich station in Germany. Like the Eiffel Tower signals these also begin with tuning V's. The Eiffel Tower tuning signals resemble the crumpling of tissue paper, but those from Norddeich are more like the squealing of a rabbit. In all there are six groups of five signals each received from the German station. So far the chief points are the great accuracy of the wireless signals and the ease with which they can be observed. They are certainly worth the confidence of navigators. Paris may be considered as 200 miles and Norddeich as 270 miles from Greenwich.—*Observatory, London.*

Tunnel Under the English Channel.—France may be connected with England by a tunnel under the Channel at no very distant date according to the project which is being discussed a present. Following this, it is now proposed to build an electric railroad line through the tunnel. Mr. W. Rose Smith is promoting this movement, and the main idea is to construct an electric railroad from London to Dover, then crossing the Channel through the tunnel to Calais, then running the line directly to Paris. In this way the trip could be made by express trains from London to Paris in a few hours. He states that French capitalists will be approached so as to promote the enterprise in that country for designing and building the Paris-Calais section as well as the French part of the Channel tunnel. It would take about five years to build the tunnel and he estimates the cost of this work to be about $25,000,000.—*London Electrician.*

A Telephone Repeater.— Inventors have been seeking for some time for a telephone relay which will act to strengthen the weak currents received and send them anew upon the line and this will be one of the most valuable inventions, should a suitable relay or repeater be found. It is claimed that telephone relays which have appeared up to the present are not of the best and are difficult to operate in practice. A German engineer, R. von Lieben, has now invented a telephone relay which is of novel character, seeing that it makes use of a cathode or X-ray tube as the principal

working part. What would appear to give confidence in the new method is that several of the leading electrical firms are said to have taken up the idea and are now engaged in experiments in the laboratory with very good results. The working of the new relay is claimed to be regular and this makes it superior to what has been heretofore brought out. Should this be true we are likely to see much longer distances realized by telephone than before.—*Elektrotech Zeitschrift, Berlin.*

Searchlights that Float in Mercury.—The new lighthouse boat which is the second of the kind to be put into use at the port of Havre, is intended to show the landing places at Havre and on the bay of the Seine which enters the Channel at this place. Ship owners have come to prefer signals which are placed not as before upon the obstacles themselves but at a distance in front of these and wish to have some of the lighthouses replaced by suitable vessels. The present boat is fitted with a well designed electric system and uses a powerful lamp composed of twelve Nernst burner rods, these being placed around a circle so as to light all the horizon. To keep the lamp level during the boat's movement, it is mounted in a mercury bath by means of a float, the bath itself being held on the usual ship's compass type of support. Thus it is found that the lamp holds very steady.—*Cosmos, Paris.*

Device to Suppress Undesirable Telephone Noises.—A Swedish engineer has invented a simple device to suppress noises in the telephone so as to be able to hear more clearly. It consists of a variable resistance which acts to suppress the induced currents to a great extent. The resistance is made up of two water columns connected together and also with the ground, the other end being connected to the telephone wires. It is coupled on to the subscriber's apparatus at each end of the line and the subscriber is able to operate it, doing this by moving a conductor within the liquid so as to regulate the resistance. He adjusts so that the sound is deadened to the greatest extent. This regulation is needed for each case owing to the fact that the noises caused by induction in the lines vary with the state of the weather, so that a frequent adjustment needs to be made, but this is very quickly done by the use of a sliding piece. Trials of the device were made not long ago on the telephone line between Westeras and Traangfors, this line having been almost put out of use by the great noise, and it was found that the noises were suppressed to a remarkable extent.—*Electricien, Paris.*

Highest Telephone Station in the World.—It appears that the highest telephone station in the world is that of the meteorological observatory on the top of Monte Rosa, at a height of 15,450 ft. Since the station is only occupied for a short period each year, the poles carrying the telephone line are removed at the end of each season and then re-erected when this is required. It is striking to see that the unusual conditions of weather which are met with in the mountain region do not hinder but really favor the working of the telephone line. Short poles are used and at the center of each span the wire touches the snow, but as the snow is quite dry it is a good insulator and no leakage troubles are found. Indeed, the final section of the line from the Col du Lys to the peak is simply laid across the snow without using any other support. Where the poles are used, to prevent any breakage of the wire owing to movements of the glacier, the line is carried through rings on the poles and is not attached fast to the insulators. The line crosses two valleys each about 3,300 feet wide and naturally they must be crossed by a single span. But the depth of the ravines is so great that the sag of the wires is of no importance.—*London Electrician.*

Subways for Constantinople.— It is to be hoped that electrical operations at Constantinople will not be interfered with by the present war as there are several important projects on hand. It is announced that an electric subway is to be built in order to connect some of the principal districts of the city, according to the plans which are being drawn up. In spite of the present critical period, the Ministerial Council found time to settle in favor of the Deutsche Bank on behalf of a group of German, French and Belgian financiers the question of the franchise for the new metropolitan subway and the project is sanctioned which calls for the subway and electric line from Taxim to Bajadiz, this representing an outlay of $75,000,000, so that it will be seen that the undertaking is an extensive one. The same syndicate already controls the city tramways which are being changed over to electric traction and about thirteen miles of new lines are in construction.—*London Electrical Review.*

Arc Carbons Made From Tar.—The John Okissons firm of Stockholm has succeeded in separating carbon from tar and it is now possible to make electric light carbons with this material. The black color of tar is in fact due to the finely divided carbon which it contains and this forms a large percentage, being about one-fourth the weight of the whole. As the liquid tar has about the same density as the solid carbon, the minute particles of carbon remain suspended in this way. By the new process the carbon can be separated from the liquid part and this latter takes the shape of a dense and transparent golden-brown liquid. What is remarkable is that the carbon has physical properties of an entirely different kind from lampblack. When compressed in molds it is found to make very good carbons for arc lamps or for electric furnace use. Carbon crucibles can also be made in this way.—*Electricien, Paris.*

Increasing the Sound of a Telephone. A novel method of increasing the sound in a telephone is to heat up the transmitter and it is claimed that surprising results can be obtained in this way. M. Petersen, a Danish engineer of Nyköbing, applies heat to the microphone transmitter so that the air becomes rarefied and consequently has a different action on the microphone, as he claims, and speech is much louder than before. Prof. Hannover of the Danish state experimental establishment took up the matter and made a number of researches showing that the effect is well marked. Then the apparatus was tested on a telephone line between Nyköbing and Copenhagen and speech was so loud at the receiving end that it could still be heard when the receiver was laid on the table and the persons stood off at some distance. It appears, however, that the idea is not a new one, as a heated microphone was used before this by the Paris telegraph engineer, Germain, with good results.—*Elektrotech Zeitschrift, Berlin.*

Memorial to Phillips of the Titanic. The memorial at Godalwing, England, to John George Phillips, the wireless operator of the Titanic, is to take the form of a cloister, with a small garden enclosed by it and with seats sheltered from the weather. This is a memorial in which the committee shows its good taste, being useful as well as attractive, especially as the farther wall is to consist of an arcade through which there will be a view of fields and wooded hills. The committee seems to be aware of the obvious fact that a memorial should not be forgotten as soon as it is set up, so here the cloister will be used and not ignored and as long as it is used it will be associated with the name and story of Phillips. The successful completion of the scheme, however, depends on whether the necessary funds can be raised, but it is hoped to secure these by the international subscription list which is now open.—*London Times (daily).*

Ozone for Sterilizing Barrels.—During the last few years the use of ozone produced by electric apparatus has reached a great industrial importance on account of its property of destroying germ life and especially for sterilizing of liquids. Even now a certain number of cities, military quarters, hospitals and large schools are using it with success for water purifying and the next step will be to apply it for wines, cider or beer. But such a method is very difficult to carry out and the problem has not yet been solved. However an important advance is made in the use of ozone for giving a thorough purifying to the barrels or other vessels and this is especially useful in the brewery industry where the barrels must be cleaned very quickly to meet the demands. Dr. Monfang's process consists in passing ozone gas through the barrels after a rapid washing, and this for about 30 seconds, or else ozonized water can be used. Then the barrel is washed with a small quantity of sterilized water and the result is found to be excellent from a germ-destroying point of view. The electric apparatus needed for producing the ozone is of a simple kind and is easily used in practice.—*Revue Scientifique, Paris.*

NEW BOOKS

ELECTRIC LIGHTING. By William S. Franklin. New York: The Macmillan Company. 1912. 295 pages with 199 illustrations. Price, $2.50.

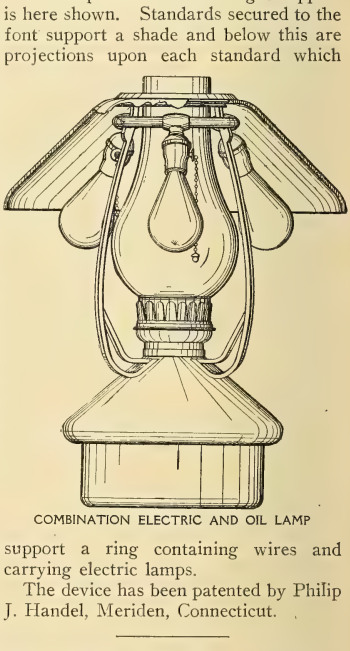
In the preparation of this book especial attention has been given to the principles which underlie operating engineering. The subject is given careful attention from station to lamp.

THE MODERN GASOLINE AUTOMOBILE. By Victor W. Page. Chicago: Norman W. Henley Publishing Company. 667 pages with 380 illustrations. Price, $2.50.

The author believes a treatise upon the motor vehicle should not assume that the reader has a knowledge of mechanics. This work is wide in scope, discussing principles of both construction and operation of vehicles propelled by internal combustion motors and is designed to be of practical value to motorists.

Combination Electric and Oil Lamp

A novel arrangement for converting an oil lamp into an electric light support is here shown. Standards secured to the font support a shade and below this are projections upon each standard which



COMBINATION ELECTRIC AND OIL LAMP

support a ring containing wires and carrying electric lamps.

The device has been patented by Philip J. Handel, Meriden, Connecticut.

How Electric Ware is Constructed

In changing electricity to heat there is no combustion, consequently there is no flame. The heat is obtained by the resistance opposed to an electric current passing through ribbons of special metal. These ribbons are sealed in the appliance and the current is conducted into them through insulated conductors. There is less danger of fire or damage through overheating in the electric utensil than in the use of any other method of direct heating.

On Polyphase Subjects

"Everyone hears better with one ear than with the other," theorizes a Chicago "hello girl." And yet if you notice you will see that in 999 cases out of 1,000 the person at the phone places the receiver to the the left ear. It is because the receiver is hung on that side of the instrument. The wire is always long enough so that the receiver can be held to the right ear, but this never seems to occur to the 'party.'

Which is Your Telephone Ear?

"He may be half deaf in his left ear and may be perfectly sound of hearing with the right, but this makes no difference. There he sits and fumes and struggles and perspires, trying to find out what the person on the other end of the line is trying to say, and all the time he is merely delaying the game by making his 'tin ear' do the work. I'm thinking of putting up a sign here over the booths, 'Are you right or left eared? Find out before calling your number.'"

An interesting if not startling fact in connection with the production of coal in the United States, according to the United States Geological Survey, is that in each successive decade the output is practically doubled. If the production of bituminous coal alone were considered, the record for the last 50 years would show an increase somewhat in excess of this ratio. The increase in the production of anthracite has been much less rapid on account of the limited area of the fields, the conditions under which the industry is carried on and the restriction of the prepared sizes to domestic consumption. It has been estimated that the output of anthracite will reach 100,000,000 long tons annually before it begins to decline. The average annual production from 1896 to 1905 was 283,240,275 short tons; the average production from 1906 to 1911, inclusive, was 461,499,260 short tons, showing an increase of 178,258,985 short tons, or 63 per cent.

Coal Output Doubles Every Ten Years

The electric fan may be used the year round, yet in some instances it may be stored away during cold weather. In such cases it is well to preserve the lasting qualities and efficiency of the fan by observing certain things in getting it ready to be placed on the shelf.

Storing the Electric Fan

After having unscrewed the connecting plug at the end of the flexible cord which conducts current to the fan from the lighting socket, place the fan on a table and wipe it thoroughly with a dry cloth or dry cotton waste. Go over the whole fan carefully removing all dust. Next unscrew the caps of the oil cups which are at each end of the armature shaft and fill them with good lubricating oil. Replace the caps and wind the flexible cord around the base of the fan.

To cover the fan place a large, heavy, paper bag over it, tying the neck of the bag tightly around the base of the fan, and it is ready to be set away.

When the bag is removed the next season the fan will be in good condition and ready to run. An electric fan thus protected during the winter and oiled two or three times during the summer should give satisfactory service for many years.

Teacher — What is velocity, Johnny?

Johnny — Velocity is what a fellow lets go of a wasp with.

* * *

"Is you gwine to let dat mewel do as he please?" asked Uncle Ephraim's wife. "Wha's you' will power?"

"My will power's all right," he answered. "You jest want ter come out hyar an' measure dis here mewal's won't power."

* * *

It is said that a young man, while attending the La Crosse, Wis., fair, dodged an auto and had just got out of the way when a motorcycle whizzed by, barely missing him in its meteoric flight. "Golly," he remarked, "I didn't know the darned thing had a colt!"

* * *

"What's the matter with Briggs?"

"He was getting shaved by a lady barber when a mouse ran across the floor."

* * *

Teacher — Johnny, what would you do if another boy called you a story teller?

Johnny (aged six) — To my face?

Teacher — Yes.

Johnny — About how big a boy?

* * *

"Why did you strike the deceased on the head with an oar after he had rocked the boat and fallen out?"

"Because he knew how to swim."

* * *

The female suffrage orator stood upon her platform and looked over the sea of faces.

"Where would man be to-day were it not for woman?" she inquired.

She paused a moment as she gazed around the hall.

"Again I repeat," she said, "where would man be to-day were it not for woman?"

"In the Garden of Eden," answered a male voice from the rear.

* * *

Potash — Cohen can nefer make a goot goluf blayer.

Perlmutter — For vy not?

Potash — He nefer hollers fore — always he yells dree ninedy-eight.

A prominent bridge player went to her doctor before taking an ocean trip and asked: "Doctor, I want to ward off seasickness on this trip so that I can play bridge and enjoy myself. Now, some of my friends say I should eat all I want and others say I shouldn't eat a thing. Which should I do?"

"Well, ma'am," replied the doctor, thoughtfully, "it's only a question of whether you prefer to discard from strength or weakness."

* * *

The garage keeper's little daughter never had happened to see a dachshund before.

"Look, papa!" she exclaimed. "See what a long wheel base that dog's got!"

* * *

First Motorist—What is the name of this big cemetery we are passing?

Second Motorist—That's not a cemetery, my dear boy; those are milestones.

* * *

Old Gentleman—Now, kiddies, do you want me to have a game of romps with you? Eh?

Youngster—Oh, no! We're playing at Indians, and you're no use. You're scalped already!

* * *

Uncle Jack—I understand the angels brought you a little brother last night.

Small Bobby (pityingly)—You'd better come over to school to-morrow and join our class in sex hygiene.

* * *

Interlocutor—That's right, go ahead and tell all you know. It won't take long.

End Man—Yassah, I guess I might as well tell all we bofe know—it won't take any longah, yah, yah, yah!

* * *

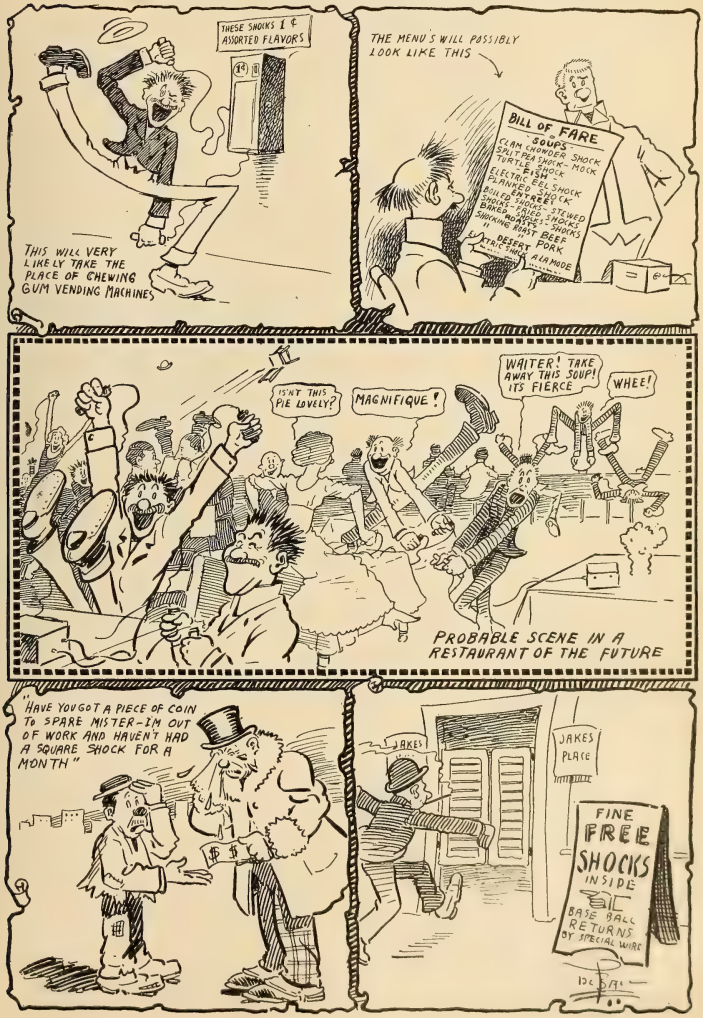
Georgia Lawyer (to colored prisoner)—Well, Ras, so you want me to defend you. Have you any money?

Rastus—No; but I'se got a mule and a few chickens, and a hog or two.

Lawyer—Those will do very nicely. Now, let's see; what do they accuse you of stealing?

Rastus—Oh, a mule and a few chickens and a hog or two.

THE LATEST SCIENTIFIC IDEA IS THAT THE MAN OF THE FUTURE WILL GIVE UP BEEFSTEAKS AND OTHER FOODS AND NOURISH HIMSELF WITH ELECTRIC SHOCKS

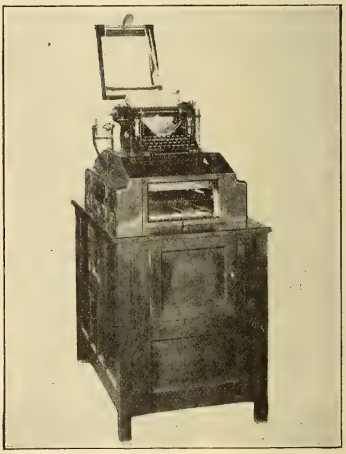


Automatic Typewriter

A machine operated by electricity that will write as many real typewritten letters each day as can be written in the same time on six machines is here shown.

The "filled in" circular letter is too often consigned to the waste basket unread. The letter in which every word is actually typewritten receives attention. Hence the field for such a machine as described.

The equipment consists of the operator and cabinet, a perforator, an automatic letterhead feeding device and an Underwood typewriter. The letter is first written upon the perforator which is operated like an ordinary typewriter. The perforator punches holes in a sheet of paper, each perforation corresponding to a letter on the typewriter keyboard. Then, somewhat similar to the perforated rolls of the player piano, this roll is placed in position in the "operator" as it is called, a one-tenth horsepower electric motor is started and the operator turns out real typewritten copies of the letter perforated on the roll. Completing the machine is a mechanism for automatically placing letterheads in the typewriter. This mechanism takes a letterhead from a holder at exactly the right moment, drops it into the typewriter and brings it at the same time into proper registration with the date line. When the supply of letterheads is exhausted the motor is shut off automatically.

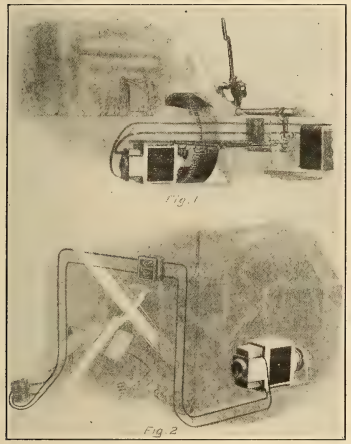


THE OPERATOR, SHOWING THE LETTER HEAD FEED MECHANISM

THE PERFORATOR

Automobile Self-Starter

An electric self-starter used as standard equipment on Haynes motor cars consists of two separate but correlated elements, the generator and cutout, Fig. 1, and the battery, self-starting motor and lamp system, Fig. 2. The twelve volt generator is mounted on the right side of the motor and is driven from the right



AUTOMOBILE SELF-STARTER

cam shaft. It is wired to a cutout on the dash, which alike automatically prevents overcharge of the battery and leakage of current from thence to the generator armature at slow speeds. The battery which is carried on the left running board is of 100 ampere hours capacity. Five lamps are supplied from this battery.

The starting motor which is supplied from the same battery has, like the generator, but two connections. It is geared to the flywheel by means of teeth cut in the latter's periphery, a sliding gear on a short idler shaft geared direct to the motor armature meshing with these teeth. The starting motor is mounted on the left side of the engine, forward of the flywheel and beneath the frame. The control of the sliding gear is accomplished by means of the gear shaft lever. A quick forward thrust on the lever throws the sliding gear into mesh with the teeth on the flywheel, thus starting the motor. The lever is automatically returned to neutral upon the response of the engine.

New Kind of Insulating Glove

Rubber for insulating gloves was naturally tried at the very outset. But rubber as a glove material has never proved very satisfactory. While it has high resistance to puncture by the current it does not wear well against such abrasion as a working glove always receives, while it causes sweating with consequent discomfort and slipperiness of the hands.

From the standpoint of durability, of course, leather has always been recognized as the ideal material for linemen's gloves; but how to render it sufficiently

INSULATING GLOVE

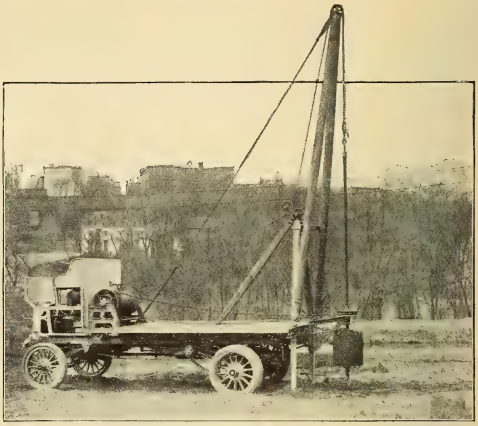
resistant to high voltage currents became a question which for years was a puzzle to tanners and scientific experts.

Now, however, success is announced in producing a leather, called Rezistol, which has not only unusual wearing qualities but also a very high degree of resistance. The gloves made from this leather bear the same name and are now on the market.

Very thorough resistance tests have been made on these gloves and they indicate that what is a new and very valuable insulating material for other purposes has been discovered.

Brain versus Brawn

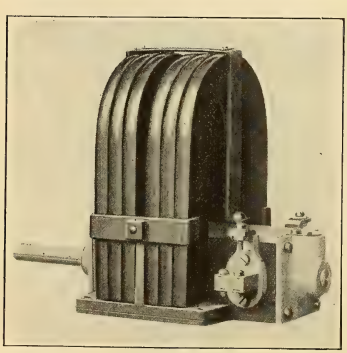
The digging and setting of telephone and electric light poles usually requires the services of nine men and a foreman at an average cost of about $42 per day for the erection of ten poles. With the apparatus illustrated, which can be used both as a derrick and a power driven pole hole digger, the setting of 20 poles per day with the services of five men is a fair average. The truck is gasoline driven with the transmission gearing arranged to operate either the windlass or the truck.



POWER DRIVEN POLE HOLE DIGGER

Electric Speed Indicator

The desirability of knowing the speed of vehicle, machinery, or shafting at any time, is something that is now generally understood in every branch of industrial work. The electric speed indicator here illustrated consists of a Holtzer-Cabot magneto generator, a form of small dynamo, and used in conjunction with a Westinghouse measuring instrument. The magneto is attached to a pulley or shaft of the apparatus the speed of which is to be measured, and since the voltage of the magneto generator is proportional to its speed, the meter which is properly calibrated indicates the speed directly at any time. When operating at 1,000 revolutions per minute, the magneto generates 25 volts so that the meter may be calibrated for any unit, as revolutions per minute, cycles per second, percentage fast or slow, or feet per minute.



MAGNETO WHICH OPERATES A SPEED INDICATOR

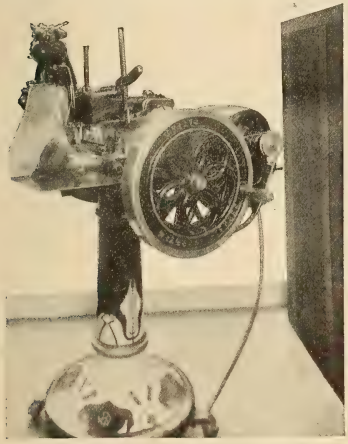
On account of the ease with which these indicators may be adapted to the many types of machinery, they find a wide field of application. The meter may be mounted some little distance from the magneto generator, so that it is possible to locate a number of the meters in one place, for those in charge to note the efficiency of the work in the various departments at any time. In connection with newspaper presses, the application is to note the number of copies being printed at any time or the total number of an edition.

A comparatively new use of speed indicator is for determining the speed of

trains or electric cars. The indicator may be attached to the axle and, if the meter is adjusted to prevent jar, this will give excellent results.

Meat Slicing Machine for Butchers

The V. B. P. slicer, as it is named, is used to slice dried beef, bacon, boiled ham and all kinds of boneless meats, producing a perfect slice of uniform thickness all the way through. A change in thickness can be made in a second by a single adjustment. Anyone who has ever had to remove rind from bacon knows how difficult it is to do it without waste. An attachment on this machine removes rinds at the same time that the slicing is done. One motion on the slicer



ELECTRICALLY OPERATED MEAT SLICER

simultaneously removes the rind and does the slicing, resulting in a saving of time and meat. It is a great time saver for the butcher.

The knife is a finely tempered disk with a razorlike edge which is maintained by a patented automatic sharpener. The work of sharpening requires only a few seconds. To prevent any accidental contact with this sharp knife, an efficient knifeguard is provided, which affords protection to the operator and renders the machine safer to handle than the butcher's knife.

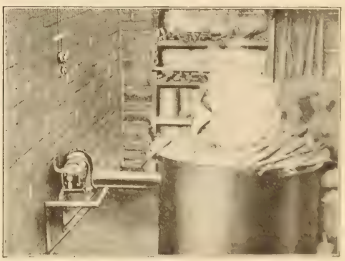
The sanitary features have not been overlooked and close examination will reveal no crack or crevice of the machine where small particles of meat or dirt can lodge.

The machine has a normal capacity of approximately 50 slices per minute, though this can be varied to values either below or slightly above if desired, though the higher speeds are not recommended. Sixteen different thicknesses of slices are provided for by single adjustment which may readily be made by the operator. The motive power of the machine is a one-half horsepower Westinghouse motor.

A Forge Blower

The blacksmith who uses only a single fire may still profitably use electric current in connection with the blower. A small motor taking no more current than the ordinary incandescent lamp may be used in conjunction with a small centrifugal blower and arranged as shown in the illustration. No levers, belts or gears are required.

It is maintained that the electric forge-blowers are of high mechanical efficiency and hence have small current consumption. They are also quiet running, while the "howl" of the ordinary blower is

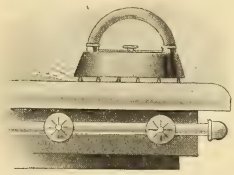


FORGE BLOWER

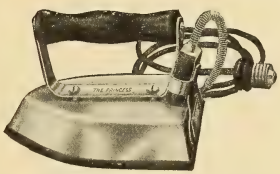
almost unbearable. At the same time they provide a larger volume of air at ample pressure and produce quick and hot fires because of perfect combustion of fuel in the fire bed.

Pressing-Iron Economy

Many people forget when comparing ironing by electricity with the old way that three-quarters of the heat that



THE GAS STOVE WASTES HEAT IN ALL DIRECTIONS



HEAT IS GENERATED WHERE IT IS NEEDED IN AN ELECTRIC IRON

should go into the old type of iron escapes from the stove into the air. Graphically this waste is presented to the eye in the illustration, and in hot weather is emphasized more thoroughly when either the cook stove or gas stove used for heating the iron brings the temperature of the room to an uncomfortable point.

With the Princess electric iron the heat is made within the iron, exactly at the point needed, with no loss of heat, no heating of the rooms, no walking between board and stove.

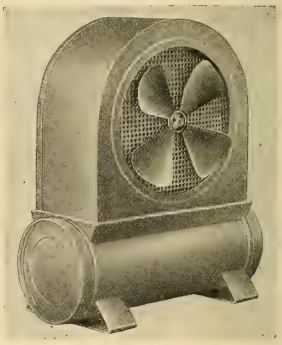
The heating element is constructed of Nichrome ribbon wire wound on mica and sealed between sheets of the same material. It lies inside flat on the face of the iron, applying the heat where needed. Three minutes after turning on the current the iron is ready for use. The handle is large, is shaped to fit the hand and has an ebonized finish. The cord is detachable at the iron by a simple pull of the free hand. The plug making this connection is encased in metal and when attached is held firmly in place by a metal sleeve, removing all strain from the terminals.

Electric Perfumer and Disinfector

Have you ever stood among the pines in their native forest after a rain storm and noticed how cool, clean and refreshing is the air?

Would you like to sit in your own home or office and breathe the same "forestized" air, or enjoy the same privilege when you go to the cafe, hotel, club, lodge room and similar places of assembly?

The accompanying illustration shows a device designed for bringing about this



ELECTRIC PERFUMER AND DISINFECTOR

pleasant state—the Glendale electric perfumer and disinfector. The fan, obtaining power from a dry battery contained in the base, is surrounded by a perforated metal receptacle containing a wick which

can be saturated with any desired perfume, the odor from which is emitted immediately upon turning on the current. Oil of pine needles, lilac water and menthol, formaldehyde and spirits of cologne are some of the liquids used.

Kerosene Torch

The gasoline torch has gradually become a luxury on account of the increasing the price of gasoline. Inventors have

KEROSENE TORCH MUCH USED IN RAILWAY WORK

therefore turned their attention to the production of a torch that will operate effectively, using kerosene.

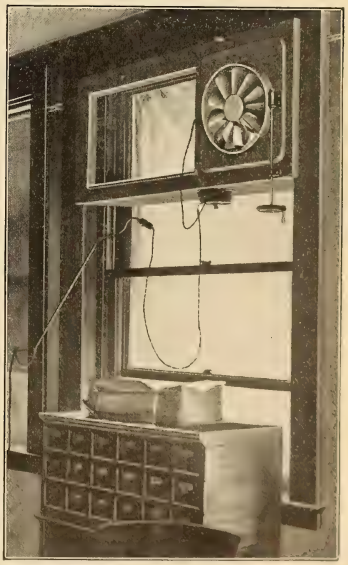
The Hauck heater, in a large size, is shown in the illustration. This tool is used by electric railways in rail bonding, brazing and in other heavy work. It consists of a seamless steel tank, equipped with hand air pump, pressure gauge, twelve feet of oil hose, a patented burner which can be used with kerosene oil as fuel, with a pressure on the tank of from 25 to 50 pounds. The flame is steady, giving intense heat, without smoke or smell.

Small hand torches operating on the same principle are also made.

An Office Ventilator

This office ventilating fan is designed to be placed in the top sashes of windows or in transoms and at slight expense. It includes a 12½ inch Ventura fan with a cast iron housing. The fan is driven by a motor which is adapted to run from a connection to the light socket.

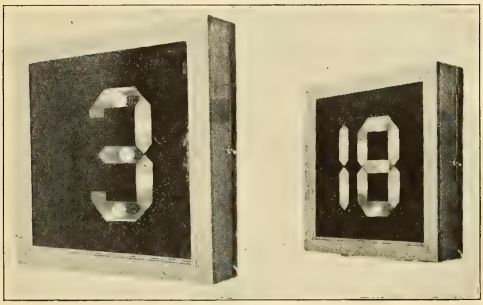
An ingenious reversing mechanism makes it possible to discharge the air straight ahead, upward toward the ceiling, downward toward the floor or at any intermediate point. Pure, invigorating air introduced under slight pressure can be supplied at will without direct draft or directly onto occupants. A simple turn of the hand wheel, seen in the illustration, reverses the outfit so that it exhausts from the room, thus providing for absolute ventilation by complete air change.



OFFICE VENTILATOR

New System of Electric Number Signs

The new Mickelwright number indicator, an English idea, is intended to show illuminated numbers by electric lamps in a much more economical way than usual, as it uses but ten lamps for each figure. Supposing a single figure, which gives any number from 1 to 9; this requires only eleven wires to be connected from the sign to the controlling switch. Usually a figure display is made up of a much greater number of lamps and the wiring is more expensive. One of the single figure indicators is illustrated and it is made up of small metal reflectors containing the lamps, the whole being enclosed as usual in a box with a colored glass panel in front in red or green glass. In another view is the two figure pattern with the figure 1 on the left and the variable figure from 0 to 9 on the right, so arranged as to show the figure 8; 19, 13, 12 or any other number of two figures can be shown by properly switching the lamps.



NEW ELECTRIC NUMBLR SIGNS

In this case only twelve lamps are used for the whole. Such indicators are useful in music halls or moving picture theaters to show the program numbers, in public dance halls, also in restaurants for orchestra numbers. Railroads use them to show train numbers, and they are also employed by omnibus and tramway lines. The small cost of these indicators will probably favor their more extensive use.

General Utility of the Modern Searchlight

Prominent among the industrial applications which have lately proved the utility and worth of the searchlight projector may be mentioned the installation at the mine of the Telluride Company, at Telluride, Colorado. Here, five lights ranging in size from nine to eighteen inches have been used with success

STEAM SHOVELS WORKING BY SEARCHLIGHT—UTAH COPPER COMPANY

for illuminating cars, workings and approaches to the mines, as well as to facilitate night work, to guard the trails and roads to the mines and mills and the approaches to the power plant.

The Utah Copper Company's mine in Bingham Canyon, Utah, was originally worked as a placer gold camp, then as a ground silver lead proposition and has finally developed into the largest low grade copper mine of its type in the world. In 1906, the work of mining with steam shovels was commenced. The terraces extend outside the canyon for a distance of 1,500 feet.

It is obvious that economical management of an industry of such magnitude requires its operation by night as well as by day. The problem of adequate night illumination, however, was one not easily solved. Electric lights, either arc or incandescent, as ordinarily installed for illuminating purposes, proved impossible because the ore and low grade porphyry is broken from the terraces by blasting before loading into the cars. Arc and incandescent lamps were so frequently shattered by blasting, and by falling and flying rocks that they were found impracticable. In the fall of 1909 three eighteen inch searchlights were installed in a house on the opposite side of the canyon, distant about 1200 feet from the workings, and have been in successful operation ever since. During the loading period the shovel is "picked up" by the searchlight, which follows it during its movements.

BATTERY OF THREE, EIGHTEEN-INCH SEARCHLIGHTS AT THE STEAM SHOVEL WORKINGS OF THE UTAH COPPER COMPANY

Photographs of the novel use of searchlights as depicted in the accompanying illustrations were obtained through the courtesy of the General Electric Company.

"When Benjamin Franklin wandered into the limelight with a loaf of bread tucked under his arm, he never could have dreamed that the mysterious electricity he was to bring to earth with his little kite would one day be made to mix dough and bake the bread, but that is what has happened."

A Regulating Socket

The Wirt regulating socket is nothing more or less than a little rheostat for dimming lamps or regulating the current to small motors as, for instance, those used in connection with massage vibrators. It is constructed with a thick brass shell with threads at one end for screwing into the lamp socket and interior threads at the other for receiving a lamp or a plug from the motor. Resistance wires are contained in this shell. Adjustment is made by turning the milled fiber ring shown in the illustration; turning it one way causes the light to grow dim or the motor to run slow. Turning it in the opposite direction has the opposite effect.

REGULATING SOCKET

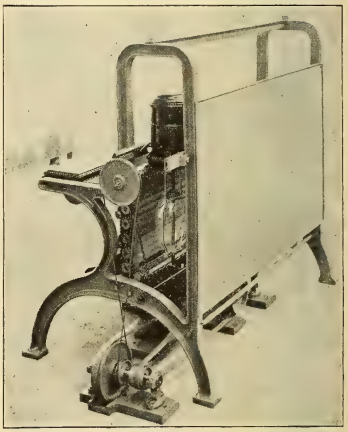
For the Man who Shaves Himself

The man who shaves himself appreciates a light that can be properly arranged with reference to his face and the mirror. The device shown in the illustration is made to meet this need. On account of its unique construction the lamp and mirror may be conveniently adjusted. In case one desires to sit down while shaving, the lamp and mirror are made up to set on a table or stand.

SHAVING MIRROR AND LIGHT

English Blue-Print Machine

The accompanying illustration represents an improved English model of continuous blue printing machine. It will copy tracings of any length in one piece, while small tracings can be fed into the machine one after another and side by side, thus saving the time occupied in loading and unloading a printing frame and reducing the cost of paper.



BLUE-PRINTING MACHINE WITH TRAVELING ARC LAMP

The floor space occupied is small and the simplicity in construction and simplicity in working are most desirable. The tracing and sensitized material can be fed into machines at table height while all operations, viz., the feeding in of tracing and sensitized material and the taking out of copies, can be performed without stopping the machines.

The single arc lamp travels backwards and forwards across the view plate.

POPULAR ELECTRICITY MAGAZINE

In Plain English

HENRY WALTER YOUNG, Editor

Vol. V | **February, 1913** | **No. 10**

CONTENTS

	Page
Electricity Ousting the Steam Locomotive	1009
The First All Metallic Telephone Circuit	1014
Huge Garage for Electrics	1014
Strange Light from the Andes	1015
Making Salt from Sea Water	1016
Aeroplane Phonograph	1017
Steam Shovels Give Way to Electric	1017
The Wonder-Work of the Mohawk Valley	1018
A General Alarm for Telephone Systems	1024
Light: Its Use and Misuse	1025
Sentenced by Telephone	1029
Jumbo—A Relic of the World's First Central Station	1030
Army Repair Shop on Wheels	1031
Color Composition of Gas and Electric Lights	1031
Miniature Railway in a Steel Plant	1032
The Eustis Turbine Windmill	1033
Miners' Electric Safety Lamps	1034
Pursuit of the Nitrogen Atom	1035
Behind the "Scenes" in a Moving Picture Theater	1036
Arc Lights and High Class Photography	1040
Modern Underground Work	1041
Plans to Outdo the Eiffel Tower	1042
Telephoning Through the Tow Line	1042
Vacuum Act	1043
Fan in Blacksmith Shop	1043
The Divining Rod	1043
Brobdingnag and Lilliputian	1044
Illuminated Semaphore Signal	1045
Electric Ghosts	1045
Electric Lights Send Children Home	1045
Uncle Sam Investigates Electrical Disturbances	1046
Hints on Using the Long Distance Telephone	1048
Dr. Alexander Graham Bell	1049
The Master Organ Builder	1050
London Nerve Shatterers	1054
Neon—A New Element with a Future	1054
Electricity in Volcanoes	1055
Electrified Water Sprays to Encourage Crops	1056
Cable Splicing on Snow Shoes	1057
Running a Farm by the Power of a Brook	1058
"Cold Light"	1059
College Men in the Central Station Business	1059
Sheep Shearing in England	1060
Two Great Scenic Railways of Mexico	1060
Electric Broiling in the Engineers' Club	1061
Of Interest to Elks	1061
A Future for the Farm Engineer	1062
French Automobile Searchlight	1064
Effective Indoor Sign	1065
The Great Arlington Towers	1065
How Rubber Came into the Electrical Industries	1066
Railless Electric Traction in Dundee	1067
Putting the Lead Sheaths on Cables	1068
Electrocution of Superfluous Animals	1069
"Readiness to Serve"	1069
Tungsten Electric Furnace	1069
Wonderful Laboratories of the Sorbonne	1070
Telegraph Crossarms After 43 Years	1071
And Then the Turks Began to Fight	1071
Car Location Board	1072
Felling Trees with Electric Saw	1073
Electrical Men of the Times. General George H. Harries	1074
Electricity to Settle Cement Dust	1076
Laying Cables in Barbados	1077
Electric Seasoning of Wood	1077

Electrical Interests of Women

A Valentine Tale	1078
Cleaning Silver	1079
Illuminated Flower Holder	1079
Electric Cooking	1080
The Art of the Housewife	1081
Vaiuria Glass Table Lamp	1081
Electric Power Dish Washer	1082
Ideal Bed Blanket	1082
ntered Apprentice and the Electric Laundry Machine	1083
per Placing and Shading of Lights	1084
The Lighting of Cafes	1084
Economy of Electric Ware	1085

Junior Section

Electric Starter for Balky Horse	1086
The Electric Crater	1086
Transporting an Engine by Cable	1087
Magnetized Borers	1087
Native Telegrams in China	1087
Columbus and the Magnetic Needle	1087
The Only Earth Electrical Clock	1088
Simple Experiments with Electricity	1089
A Magnetic Navy	1089
Speed of Pitchers Tested by Electricity	1090
Convicts See Moving Pictures	1092
Electrically Operated Toy Semaphore	1092

Popular Electricity Wireless Club

The Radio-Automatic Torpedo	1093
Telfunken Wireless Compass	1094
Wireless Club Directory	1094
Correction	1094
Weather Bulletins for French Air Pilots	1095
Aeroplane Wireless Experiments in France	1096
Setting Railroad Clocks by Wireless	1096
The Frog Muscle Experiment	1097
P. E. Wireless Club Member in South Africa	1097
Questions and Answers in Wireless	1098
The Brush Discharge	1100
Improvement in Leyden Jars	1100

For Practical Electrical Workers

Motor Boat Ignition	1101
Protectors of the Network	1108
Film Mending Machine	1109
Odd Current Distributing Insulator	1109
The Electrician's Stationery	1109
Heat Cells	1110
Moving Panoramic Sign	1111
Measurement of Water Flow	1111
The Tumbler Boxes	1112
Photo-Electric Cells	1112
What is an Electrolier?	1114
Flashing Election Returns	1114
Electricity, Candy and Champagne	1114
Ladder for Lamp Tending	1114

Miscellaneous

Electrical Securities	1115
Cumulative Preferred Stock	1120
Bonds as an Investment	1121
Curious Uses of the X-ray	1121
Science Extracts from Foreign Journals	1122
Electricity from the Sea	1125
Electro-magnetic Velocity	1125
New Books	1125
From the Land of the Sultan of Sulu	1126
Possibilities of Trade with India	1127
Short Circuits	1128

Electric Current at Work

Warning to Motor Speeders	1130
An Office Convenience	1131
Battery Wound Clock	1131
Taking the Motor to the Work	1132
Automobile Electric Starter	1132
Instrument Sterilizer	1133
Collapsible Electric Light Holder and Stand	1133
Air Humidifier for Mines	1134
Heats Water as Used	1134
Coin Operated Photographing Machine	1135
Vibrating Rectifier	1135
Spray Bottle Warmer	1136
Cord Adjuster	1136
Hanging the Bread on the Toaster	1136

WALS When your subscription expires, you will find a renewal blank enclosed here. You should fill out and return with remittance at once to avoid missing a number. Positively no copies will be mailed ...iption after same expires unless renewed, and we cannot agree to begin subscriptions with back numbers. ...pper of your magazine shows issue with which your subscription ends. The extension on this date to period ...al is sufficient receipt. If any other is desired it should be requested at time of renewal.

OF ADDRESS Notify us promptly of any change in your address, giving both the old and new location. Since our mailing list for each issue closes the 5th of the pr... list for February closes January 5th), changes received after the 5th must necessarily take effe... ...ond month following. Postmaster as well as Publisher should always be notified of changes in order ... ...o old address.

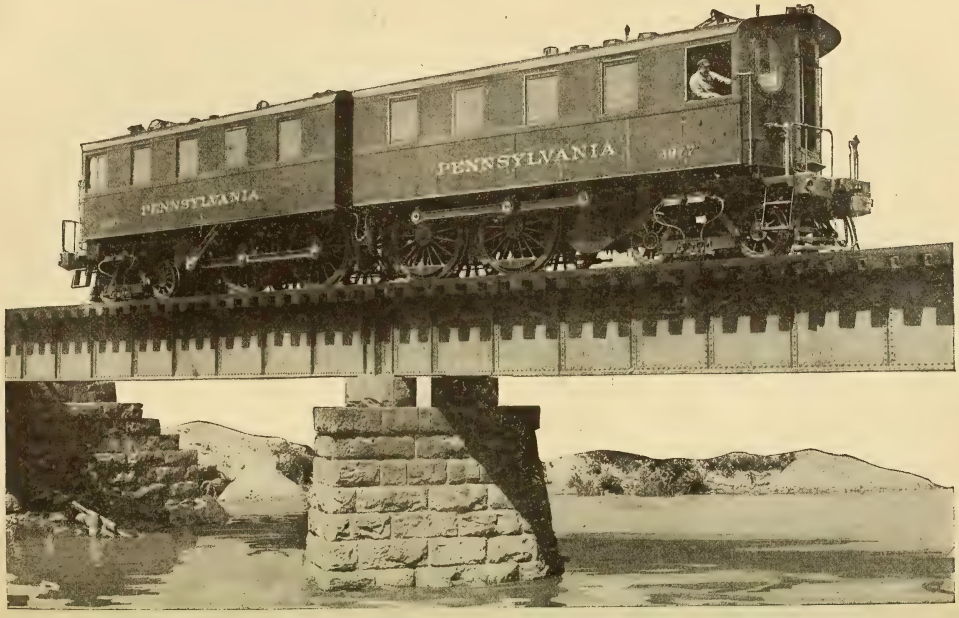
ISSUED ... POPULAR ELECTRICITY PUBLISHING CO., Commercial Bldg., Chicago, Ill.

YEARLY ... $1.50; CANADIAN, $1.85; FOREIGN, $2.25; SINGLE COPY, 15 CENTS

... will be sent after expiration of subscription except upon renewal.

Entered as ... April 14, 1908, at the Post Office at Chicago. Under Act of March 3, 1879.

...ht 1913, by Popular Electricity Publishing Co.



"THEY DREAMED OF A DAY WHEN THE CLEAN ELECTRIC TRACTION THEY HAD HEARD SO MUCH ABOUT WOULD COME"

Popular Electricity
In Plain English

VOL. V. FEBRUARY, 1913 No. 10

Electricity Ousting the Steam Locomotives

By EDWARD LYELL FOX

A blunt, shapeless cab, a string of cars in its wake, comes sliding along the tracks. On either side the meadows nod drowsily—brown reaches of rank grass. But so quietly does the strange procession move across them that not even a sleeping cat-tail is disturbed. On it comes until sighting the concrete platform at Manhattan Transfer its soft purring rises to a hiss, a strident, singing sound—for the air breaks are working and the train is rolling to a stop.

We watch it draw up beside the platform. We see the door of the cab roll open. The engineer steps out. His face is clean. In demeanor and appearance he is unruffled as a banker leaving his office. In the cab behind him the air has remained pure. The windows are free of smoke stains. None of the jar of the steam locomotive has shaken him. For he is the engineer of an electric train—a type that is rapidly supplanting the steam engine on most of the railroads in the neighborhood of New York City.

A few years ago the traveling public began to dream. They dreamed of a day when the clean, swift, electric traction that they had heard so much about would come—that it would cover railroad operation in the immediate vicinity of most of the big cities. For it to extend over the country was too much. That was a dream to dream when the first had been fulfilled. And now that the big railroads of the East are ousting the steam locomotive and equipping their suburban service with electric cabs it is about time that the second dream came into being.

The sight of a gigantic locomotive bellowing through the night belching fire and smoke is inspiring—but it is not clean. People to-day demand the cleanest in everything. And in railroads cleanliness has been a long time coming to them. As a matter of fact there has been little advance in this respect since a day in August 82 years ago when the DeWitt Clinton, dragging three coaches, panted on its first trip between Albany and Schenectady. Of this trip we have read:

"The smoke and sparks poured back on the passengers in such a volume that they raised their umbrellas as shields. The covers were soon burned off these and each man whipped his neighbor's clothes to put out the fire started by the hot cinders."

It was a man named Bickford, road foreman of the New York Central's electrical equipment, who told me about their system. And Bickford speaks from a broad viewpoint. For he has been both engineer and fireman.

"How," I asked him when he was finally located off duty, "does an electrical engine's equipment differ from one run by steam?"

"An electric cab," he told me, "is very simple. A steam cab is complex. On a

type of engine was evident at the outset. Later I learned that on the Pennsylvania locomotives there are reciprocating parts connecting the drive wheels. Still their engineers have by comparison little to do.

Then Mr. Bickford told me that there was a wonderful saving in time and labor,

CLEARING THE TRACK IN WINTER—ONE OF THE NEW YORK CENTRAL ELECTRIC LOCOMOTIVES

motor engine the equipment by comparison is small. There is little for the engineer to bother himself with. Indeed he is responsible far less for his electric locomotive than he used to be for his steam engine. Trained inspectors do the work for him. Besides he has much less mechanical responsibility. On our multiple unit locomotive, for instance, there are no reciprocating parts. There are few things that can become loose. The motorman makes practically no mechanical inspection unless it be to examine the rigging of the air brakes."

And so the very simplicity of this new

preparing the electric locomotive for work. Let me illustrate:

At High Bridge—what might be called the "suburban outpost" of the Central's lines—the trains on the Hudson division change engines. Steam gives way to electricity. On an extra track the great motors wait. Fifteen feet from them shine the windows of the train dispatcher's office.

And now a train from the West is coming down toward the city. At "F. H." tower three miles above High Bridge its coming is announced. A telephone bell jingles in the engine dispatcher's

office; the number of the approaching train is called out. Hearing the signal the motorman who has been asigned to take "the flyer" on the last leap toward the city hurries to his cab. In anywhere from two to five minutes he is ready. Then the inspector comes, looks at the fuses, at their openly exposed boxes; he examines the brake mechanism. Then he waves his hand.

"Clear away," he shouts.

In an instant the engine is cut out and moved out on the track.

To a man understanding railroading, the contrast between preparing a steam locomotive and the electric train is sharp. The saving in time is wonderful. Most steam locomotive engineers will tell you that it takes fully 40 minutes and sometimes more to put the big engine in shape. The railroad allots them a half hour under pay to accomplish this. But that isn't enough. Often they must encroach upon their own time to be sure that the great vehicles they drive respond nicely to throttle and brake. Steam takes 40 minutes, electricity five. The saving is obvious.

And once the incoming train is picked up the labor saving continues. Chiefly it is concerned with the reverse lever. Old engineers tell me that the reverse lever is the nightmare of their profession. They must graps it with both hands, brace a foot against the cab and pull with all their strength if the engine is to go backward. It is a task that makes an awful drain upon a man's strength. On a freight run, for instance, where there is much backing, the lever is a bugbear. Yet contrasted to this is the wonderful simplicity of the electric cab. In it the reverse lever looks like a little wrench. It can be handled as easily as the button that turns on the electric lights in a room. The strength of a child can move it.

Still another advantage is in safety. At the terminal I managed to get some information out of a Central engineer. He had just finished his run through the long tunnel, that runs under the city. Like the Pennsylvania engineer he was very calm and clean when I saw him—unlike the engineers with their black grimy faces that one sees so often hanging out of the windows of the steam cab when a run is finished.

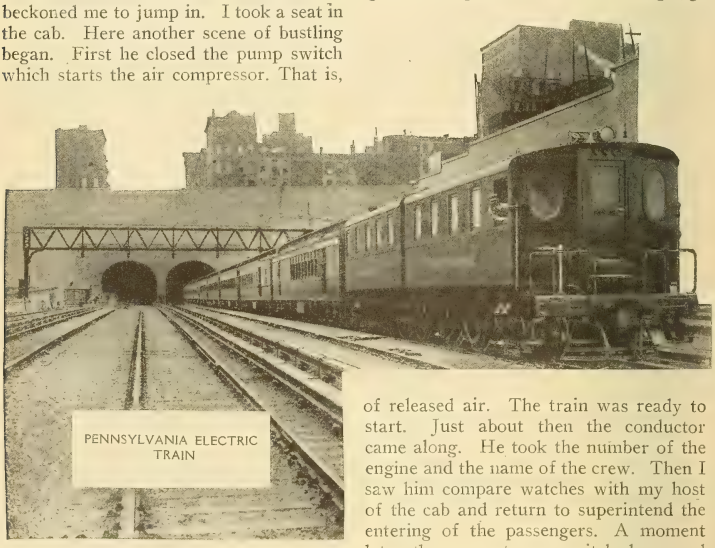
"Yes," he said in answer to a question. "Electricity has made travel through the tunnel much safer. This Park Avenue hole used to be full of smoke and steam and gas. A great number of trains ran through it. The gas came mostly from the hard coal that was used on the suburban service. All this made it very hard for an engineer to make out the signals. I know, for I got lost in there a great many times. Once I stopped as soon as it dawned upon me that we had passed signals and had not seen them. I got down with a torch and felt along the rail until my hand came in contact with the block. Then I knew for sure that we had it. Having a green fireman I wouldn't trust him to get down. I did it myself. I tell you it was hard and nasty work. There were four signals through the tunnel on each track. Sometimes that meant four stops. Now they have eleven signals. But I have never left my cab. With electricity in the tunnel instead of smoke and gas we can see everything clearly."

Later I received permission to make a run through the tunnel in one of the electric cabs. I was told to report half an hour before the leaving time of the train. When I got there I found the engineer—or motorman if you would rather call him that—examining the bulletin board. Then he compared his watch with the standard clock, registered "on" and the hours he had been "off." A moment later the train dispatcher came along and told him where his engine was stationed.

Often the electric locomotive is found on its right track, the man finishing a run leaving it there. This time, though it was out in the yard and so we began a weary pilgrimage, crossing tracks, picking our way over third rails, and standing in the little safety stations when trains came whirling from opposite directions.

The yard being on a grade we found blocks under the wheels to keep the engine from sliding back down the tracks.

I watched the engineer. He gave directions to some helpers; the blocks were removed. Then he walked along the cab, examining the contact shoe and the motor fuses. A moment later he beckoned me to jump in. I took a seat in the cab. Here another scene of bustling began. First he closed the pump switch which starts the air compressor. That is,



PENNSYLVANIA ELECTRIC TRAIN

starts it unless the fuse is blown. Then he cut in all the necessary switches to move the engine and looking through the window waited for a tiny signal beside the track to give him the word to start back into the terminal.

It was not long before the signal flashed. A switching on of the current and we were sliding back over the rails. As we neared the waiting passenger coaches he moved the air brake switch and with a soft hissing the engine bumped lightly against the coupler of the first car. I noticed that the coupling was not done until an inspector came. Then with the necessary air pressure in the train line the inspector signaled to apply the brake test. Meanwhile he was walking back beside the cars watching the different pistons and brake cylinders, watching to see if they were working properly. Then he gave a signal to release the brakes and with another simple twist of the engineer's fingers there came a long sigh of released air. The train was ready to start. Just about then the conductor came along. He took the number of the engine and the name of the crew. Then I saw him compare watches with my host of the cab and return to superintend the entering of the passengers. A moment later the current was switched on and with a low moaning sound issuing from the huge motors, we began to whirr out of the train shed. Slowly and easily we went, never gaining speed. And I was wondering at the even pace when the motorman said:

"Through the yard the speed limit is from six to ten miles an hour. We have to be careful."

Before I could comment the dark opening of the tunnel had loomed ahead and we plunged into a chaos of rumbling wheels and moaning engines. And as we rumbled along he began to call my attention to the signals—disk signals with two lights. When a red hole burned through

the darkness it meant to stop. And as we rushed on the engineer told me that the bottom light turning to yellow meant caution. In two miles of the tunnel we passed eleven of these signals. All were automatic and as soon as we saw red there was a twist of the engineer's wrist and the air brakes releasing he brought the train to a stop. Then the brakes taken off he moved ahead slowly until another block was passed.

It was slow work going through the tunnel and not until a vague light quickly brightening began to show ahead did we pick up speed. Then the power lever was pushed ahead a notch and we whirled out into the sunshine. Here we found another set of signals, only instead of being along the tracks they hung above us. These he called "positive signals" and explained to me the difference—if an engineer finds an automatic signal in the stop position, he stops, then proceeds slowly; if he finds a positive signal he stops and does not proceed until it clears or until he receives a card from the signal man telling why it cannot be cleared. A few of these and the automatic signals began again changing at intervals to the positive until we rushed through the suburbs out into the country until the North White Plains yard was reached. So our run was finished—a 24 mile run entirely by electricity with 86 signals left behind.

Later I learned that the run of the Pennsylvania system between the big terminal in New York City and Manhattan Transfer out in the Hackensack Meadows was even easier. Indeed the Central engineer said it was hard to imagine greater comfort in train operation than the handling of an electrical locomotive through the clean straight tube under the Hudson River, under Bergen Hill and out across the meadows. The Pennsylvania engineer sits in a little compartment on the front of the locomotive. A big window is before him giving a clear view of the track. The master controller is at his elbow. Six feet away facing a similar window sits his companion.

With the left hand the engineer pushes over the lever of his controller very slowly. He does this so as to start the heavy train without blowing a fuse. With his right hand he works the little handle which applies the air to the brake. Interlocking signals guide him across the open station yard. In the tube system of blocks, signals, red and green, tell him the way is clear. A cool green light glowing ahead and he has nothing to fear. The motor is let out. It sings and the train whirls along slackening speed, perhaps, climbing the grade near the Jersey side of the river. But there is no panting like in a steam engine, no intolerable heat, nothing to make the trip anything but quick and clean.

Yet in spite of all these advantages old-time engineers are against the electric locomotive. Their attitude resembles the "stand-patter." The operation of an electric or multiple unit train calls, you see, for less expert knowledge. Long experience is unnecessary. It would take away from the profession of an engineer something of its exclusiveness. It would make competition more general and possibly reduce wages.

Four years before, Henry C. Case ran a steam locomotive for the New York Central. Now he wants to get back again into the steam service. He says he is lonely. It may sound a peculiar objection but it is the objection of most engineers who ride without helpers in the Central's cabs. Psychologists say, you know, that the only real punishment is loneliness. And loneliness is intensified when a man is whirling ahead 50 miles an hour with nothing but a piece of glass in front of him. Should there be a collision there is nothing to stand the shock of a crash. Nothing like on a steam locomotive where the long boiler takes the shock. So you see, they are not only afraid of wages being cut, of new men overcrowding the field, but they fear the loneliness of that wild ride—a loneliness that some day may make them think a red light is green and beckon them on to destruction.

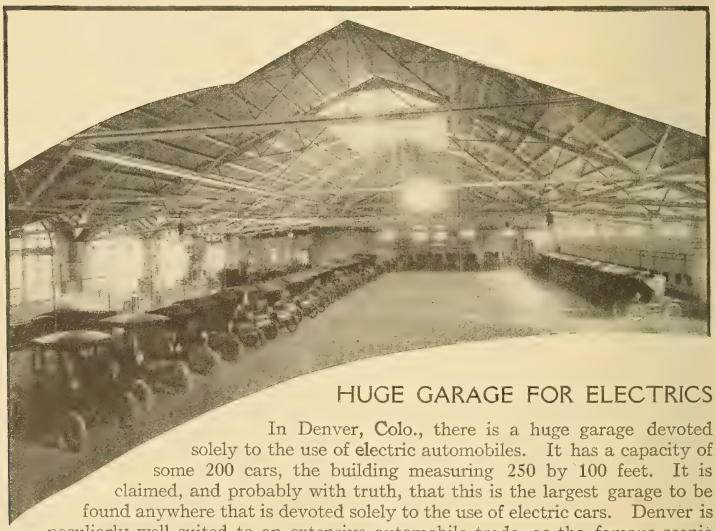
The First all Metallic Telephone Circuit

The telephone business did not really begin to grow big and overspread the earth until 1896, but the keynote of expansion was first sounded by Theodore Vail in the earliest days, when as yet the telephone was a babe in arms. In 1879, according to telephone history, Vail wrote to one of his captains:

"Tell our agents that we have a proposition on foot to connect the different cities for the purpose of personal communication and in other ways to organize a grand telephonic system."

This was brave talk at that time, when there was not in the whole world as many telephones as there are to-day in Cincinnati. It was brave talk in those days of iron wire, peg switchboards, and noisy diaphragms. Most telephone men regarded it as nothing more than talk.

Four months after he had prophesied the "grand telephonic system," he encouraged Charles J. Glidden of world-tour fame to build a telephone line between Boston and Lowell. This was the first inter-city line. It was well placed, as the owners of the Lowell Mills lived in Boston and it made a small profit from the start. This success cheered Vail on to a master effort. He resolved to build a line from Boston to Providence and was so stubbornly bent upon doing this that when the Bell Company refused to act, he picked up the risk and set off with it alone. He organized a company of well known Rhode Islanders—nicknamed the "Governors' Company"—and built the line. It was a failure at first, and went by the name of "Vail's Folly." But Engineer Carty, by a happy thought, doubled the wires, and thus in a moment established two new factors in the telephone business—the all-metallic circuit and the long distance line.—*History of the Telephone.*



HUGE GARAGE FOR ELECTRICS

In Denver, Colo., there is a huge garage devoted solely to the use of electric automobiles. It has a capacity of some 200 cars, the building measuring 250 by 100 feet. It is claimed, and probably with truth, that this is the largest garage to be found anywhere that is devoted solely to the use of electric cars. Denver is peculiarly well suited to an extensive automobile trade, as the famous scenic characteristics of the surrounding country draw thither thousands of summer tourists.

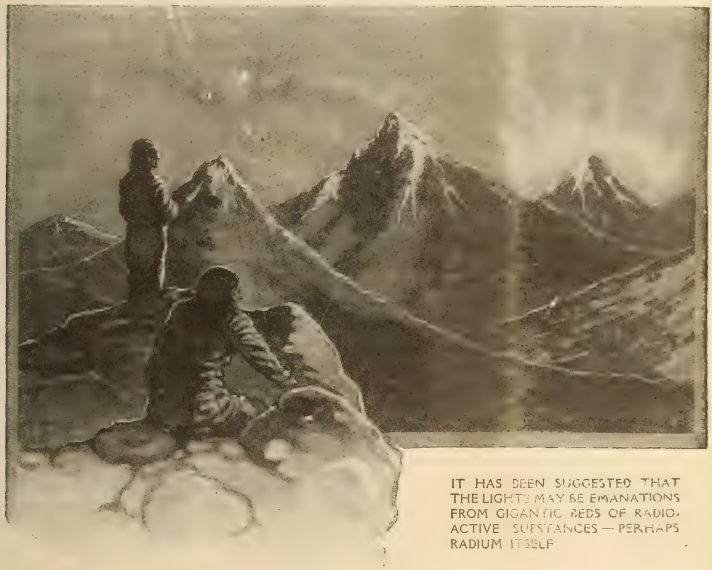
Strange Light from the Andes

The Chilean government, acting with Bolivia and Peru, has appointed a commission of scientists to investigate a strange light which flashes from the Andes in Chile. The light is visible 500 miles from the main range and is believed to be electrical in origin. It emanates directly from the mountains themselves.

Dr. Pedro Santinez, one of the commission selected, writing of the extraordinary phenomenon, says:

"The light is ordinarily of a glistening appearance and has the shape of a bold curve. It appears to have fixed points of issue and changes only in the frequency of its discharge and in its extent. The most vivid flashes come from a definite point, and the radiation sometimes reaches far above the zenith and away to sea. The extraordinary phenomenon can be seen with greatest ease when the sky is clear.

"The flashing begins late in spring and lasts until early winter. Toward the south then the light ceases almost altogether. But in northern and central Chile, in Peru and Bolivia the flashes are intermittent throughout the winter.



IT HAS BEEN SUGGESTED THAT THE LIGHTS MAY BE EMANATIONS FROM GIGANTIC BEDS OF RADIO-ACTIVE SUBSTANCES — PERHAPS RADIUM ITSELF

"A suggestion has been made that the light may not be electrical at all; that it may be emanations from gigantic beds of radio-active substances, perhaps radium itself. If this latter theory is correct, the Chilean Cordilleras hold a hoard which will change the destinies of the world.

"During the great earthquake of August, 1906, discharges occurred along the whole crest, for I we may accept authoritative statement, the sky everywhere in central Chile then flashed with a quivering 'fire.'

"Observation leads to the conclusion that this radiance of the Andes is the result of electricity. How these discharges, which are noiseless and produce no sparks may be designated at this day is not quite clear.

"It is probable that in the Andes is a source of power such as the world has never known and which, if it can be harnessed, will be found capable of providing energy for the whole world."

Making Salt from Sea Water

The sea water of the Pacific Ocean is the source of supply of the Western Salt Company, which has its works some ten or fifteen miles south of the city of San Diego, Calif. There are about one thousand acres in the entire fields controlled by the company, and this large area is divided up into rectangular evaporation reservoirs, from which the water flows, finally, into other reservoirs for the final crystallization of the then considerably condensed salt water.

These final vats have a total area of about 75 acres and yield annually a crop of over 12,000 tons of salt. Around these crystallizing vats there is a network of narrow gauge tracks on which are operated dump cars into which the Japanese laborers shovel the salt, taking off a layer eight inches thick from the whole surface area of the vats. For this labor they get fifteen cents per car. The salt vats have much the appearance of a northern ice field and the effect if the bright sun upon the large crystals is the same as the sun upon the snow. When a number of the small dump cars have been filled with the glistening crop they are run together and hauled to the main track by a gasoline motor and are there coupled to a small electric locomotive which draws them to the yards where the salt is dumped in heaps for further treatment preparatory to shipment. These heaps attain a height of 30 to 50 feet, the salt being carried up by automatic conveyors. The tracks are laid on a grade which allows the locomotive to take the dump cars well up the side of the heaps before they are dumped. The locomotive is of a low-down type of construction, the motorman sitting in the rear of the body. An upright pole carries the trolley arm which runs along the wires of the system.

A CALIFORNIA SALT PLANT

Aeroplane Phonograph

The army officers who have been engaged in training for aeroplane scouting work in the region of Paris find that although the aeroplane is excellent for revealing objects on the ground there is a difficulty in the way of recording the observations. It is in fact very hard to do any writing upon an aeroplane, and at the same time to keep on making observation, but this drawback will now be overcome by the use of the new Roneo phonograph apparatus.

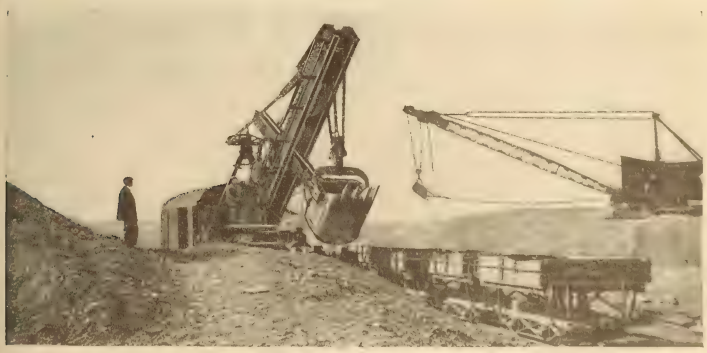
In using this the observer simply talks into his small machine which he has before him by the use of a speaking tube and thus he is able to record all his notes upon the disk instead of having to write them down. The phonograph is of special makeup for aeroplane work and is run by a small electric motor and battery. Even when in the air the disk can be put in a suitable box and dropped overboard without needing to stop, then putting in a new one and so on; or the disks can be kept and turned in to heaquarters at the end of the flight.

AEROPLANE PHONOGRAPH

Steam Shovels Give Way to Electric

Electric power has been successfully applied to operate the steam shovel and drag line excavators in use by the reclamation service in excavating at Lahonton, Nev.

A Bucyrus 60 ton shovel and a 60 ton drag line scraper are shown in operation in the picture. The power is generated in the government power plant near by, where the drop in the Trucker Canal is used to develop 1,000 horse power. With cheap power the machines are preferable to the steam shovel.



A 60 TON SHOVEL AND A DRAG LINE SCRAPER WORKED BY ELECTRIC POWER

The Wonder-Work of the Mohawk Valley

By H. Bedford-Jones

SATURDAY NOON AT THE SCHENECTADY WORKS. ABOVE IS THE PRETENTIOUS OFFICE BUILDING

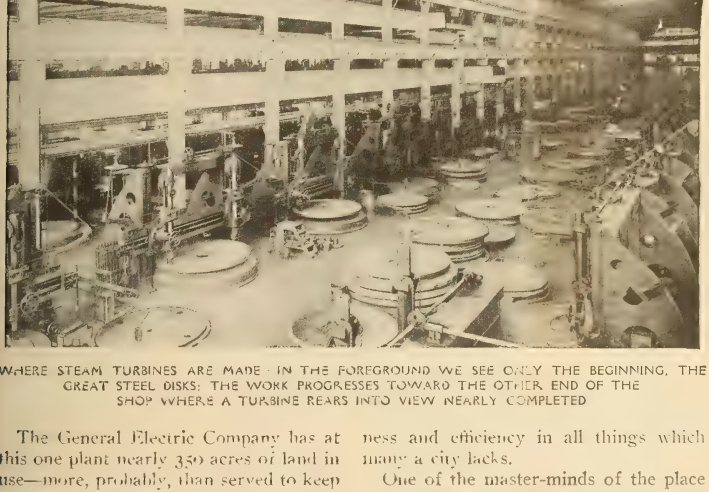
In 1901 the first large steam turbine in the world was put to work in Chicago—a 5,000 kilowatt giant which was revered as a master-work from sea to sea. Five years and eight months later it was dismantled—not of necessity, for its work was as perfect as ever—but for efficiency; in comparison of others of its kind it was no longer a giant but a dwarf, its room had become better than its company. Today that steam turbine stands in Company Street, a monument to efficiency. A few hundred yards away are constructed steam turbines of 24,000 kilowatt, or over 30,000 horsepower capacity.

It is a wonderful avenue, is Company Street in Schenectady. Starting at one end, the visitor has on either hand far reaching buildings of three or six stories. The startling thing about it all is that these buildings are numbered consecutively. These numbers are not ten or twelve, or 20 or 30, but 70, 80—on up to 150. Can you imagine it?

Here, little over a hundred years ago, were the "keepers of the eastern door," the aristocracy of the first American nation. From this valley went the delegates to the Long House—the grave Mohawks who were the proudest and oldest of the Iroquois confederacy, and who stationed themselves at the eastern door of their famous estate, the buffer against

the encroaching white race. And in their place today go forth to the uttermost ends of the earth the proudest and youngest representatives of that white race—monster steam turbine-generators from the greatest shops in the world.

And where the corn pits of the villages stood beside the river, stand today these shops and buildings where giants are brought forth. The Mohawk was inefficient. He had to go.



WHERE STEAM TURBINES ARE MADE · IN THE FOREGROUND WE SEE ONLY THE BEGINNING. THE GREAT STEEL DISKS: THE WORK PROGRESSES TOWARD THE OTHER END OF THE SHOP WHERE A TURBINE REARS INTO VIEW NEARLY COMPLETED

The General Electric Company has at this one plant nearly 350 acres of land in use—more, probably, than served to keep the entire Mohawk nation in corn. It is all historic ground about here, fought over by French and Indian, Britisher and Colonist. In the old town itself are houses dating from 200 years back, still occupied by the families of their builders. But the romance of the Mohawk valley was not ended with flint-lock and calumet. In the old days, it was the gods who made romance for men. Today it is men who make romance for the gods.

Where 18,000 men and women are gathered, working each to a given end, there must be government and systematic government. This government must be superior to the average if they are to respect it. Company Street and its environs might well be compared to a city, but they are more than that. Here are the trolley lines, the electric bus lines, the fire department, the police force, of a city. But here are also the electric railroads, the paving system, the thorough-ness and efficiency in all things which many a city lacks.

One of the master-minds of the place is a thinking machine named Charles Proteus Steinmetz, a mathematician of world wide fame who is without doubt one of the greatest scientists and electrical engineers in this country. Steinmetz came into the United States 23 years ago a penniless immigrant, a political refugee from his own land. Today he is one of the greatest figures in the electrical world, and is equally noted in other phases of life as well.

"Do you think," I asked, approaching rather diffidently to his favored topic,

THERE IS A VERY MODERN AND SANITARY RESTAURANT BUILDING ON THE GROUNDS

IN THIS RESTAURANT BUILDING ALL THE COOKING IS DONE BY ELECTRICITY

A PRIVATE TELEPHONE EXCHANGE THAT WOULD DO FOR A LARGE CITY SERVES COMPANY STREET AND ITS ENVIRONS

"that we have tapped much of the power of electricity? I mean, have we developed it as much as we may hope—"

"Ach, no!" came the explosive answer, with a wave of his ever-present cigar, long, thin and light. "Look at the coal fields of all the world—every one is mapped out and ready for development as soon as need be. Every ton of coal on this earth is known today. Even in China and Siberia, where they say so little is known, is this true. And then what? Some day, not so many thousand years ahead, there will be no more coal. Some day there will be no more of the great earth-fuel. And then what?

"Electricity, my friend! Look you at the old world. She is afraid of the great crisis already. She burns electricity today, in great part. Even here we are coming to use it more and more with each passing year. Electricity is heating our houses now. Electricity is smelting our metals now. Here in our laboratories we have electric furnaces—furnishing the hottest heat known to science. It is perhaps a little hard to control, yes, but that is nothing. All that will come. Electricity will take the place of coal, and will do the work a thousand fold better. The time is not far."

And the means of effecting this?

"Water power—the water power of the world will in the end be triumphant, my friend. Look at Japan, and our own western country. There is the greatest water power, and the cheapest electricity in the world. The cost of the power is still the great deterrent, but the future will solve that problem easily."

And this man, whose brain is in such appalling contrast with his physique, has very definite ideas on electricity itself.

"It is nothing more than a form of energy," he declared positively. "We know more about it than we do about any other form of energy. And yet it is paradoxical in that it remains mysterious to us—for intimacy kills the mystery of all other things. Only chemical energy is superior to electricity; for chemical energy alone is capable of being transported to a greater extent. But in order to save the energy which makes it pos-

sible for 90,000,000 people to live here where barely 10,000 aborigines were able to live, we must conserve our natural resources.

"The destruction of our forests will destroy our water power. Nothing else will. Utilizing the volume of its power will not hurt or diminish it. From water power we get only one or two per cent of this possible energy, and the electrical engineers of the future must learn to make use of all. We neglect it at present, because we are not forced to solve the problem. But the time is coming."

The underground system of this city of buildings is no less interesting to the engineer than the buildings themselves and the men in them. Under our feet were miles of pneumatic tubes, wires and piping systems. From the post-office to the farthest building, a mile-long tube transports a letter or order in a minute of time. There is perfect communication between the buildings, each of which is heated by the exhaust steam from the two power houses. And these power-houses, again, stand for the remarkable efficiency of this place.

I visited the old one, and stood with a fine sense of my own insignificance before the huge reciprocal engines, four of them, towering far above me, all working with whirring wheels and rumbling power. They were fed by the furnaces behind, whose automatic stokers were constantly at work, and this furnace room itself was cooler than many of the shops. Then we went to the new power house, and my guide pointed to one of the turbine generators.

"That generator," he said, "is more powerful than all those in the old power house put together!"

It was hard to believe, yet it was none the less a fact. The old power house is steadily at work, but it has outlived its day. Even now an addition is building to the new power house—begun before the building itself was finished. There is no standing still here.

A visit to these shops, in successive order, is a great education in efficiency. Here the wonder-work of today is the relic of tomorrow. We went through the smaller shops, where the tiny 1/30 horsepower motors are built, on to where the electric locomotive motors are turned out, and in another shop the locomotives themselves stood waiting for shipment. All these huge machines are put together and tested—the turbine generators in a special shop, the locomotives on special tracks, then they are taken apart and shipped out with the knowledge that they are perfect in every detail.

Here each of the mammoth buildings would have made a notable factory, were it found elsewhere. Cable works, wire works, foundries, insulating works, blacksmith shops containing rows of dozens of huge forges, shops where the smaller metal parts are punched out from strips of brass and wire and steel. Into one machine was feeding a steel wire, unwinding rapidly from a drum. I looked to see where it was going, and beneath the machine saw a huge basket, into which were dropping perfectly formed screws.

The pottery shop is an interesting place, together with the insulation presses. The latter of these are automatic moulders. Girls fill a row of depressions with the malleable rubber composition; a turn of the switch, and down comes the steel die, welding and hardening, until when the die is lifted the perfectly formed buttons and switches are there ready made. In the pottery shop much the same system obtains.

Here the clay and mixed combinations are delivered from the grinding shops. Before rows of machines stand men and women who tamp the loosely mixed stuff into the massive molds. The die comes down, exerting heat and pressure simultaneously, and when it goes up the yellowish powder has been transformed into a perfect insulator of porcelain. These are of as many different shapes as electrical work has uses for them. Rows on rows stand ready for the ovens

A FULLY EQUIPPED HOSPITAL WITH MODERN OPERATING ROOM. ACCIDENTS WILL OCCASIONALLY HAPPEN IN A PLANT SO LARGE; EVERYTHING IS READY TO MINIMIZE THEIR ILL EFFECTS

—great cylinders of brick, where the porcelain is baked and glazed and finished. So perfect are these molds that one is impressed by the very minuteness of them—the little details of their work, the delicate tubes for wires, the tiny screw holes, work done in a second which a potter could not do in hours. But all mighty works are simply matters of detail, whether destructive or constructive. The desert sand grains have worn away the Sphinx; the tiny thousands of soft-iron punchings build up the turbine generator.

The draughting department is an interesting place to the visitor, when he considers the work done here. Four hundred of the finest draughtsmen in the country work here, under engineers whose names stand in the forefront of their work. Here are nearly 300,000 plans and drawings on file in specially constructed fire proof vaults, and these are made at the rate of 35,000 a year, for there is always new work going forward and new designing to be done.

Nearby is the laboratory building—room after room filled with up to date apparatus, from electrical furnaces to huge retorts. Here the various appliances are tested and the new inventions tried out to the last detail before going forth to the outer world. But greater than all else in this wonder-plant, where electrical apparatus of almost every description is built, is the final cumulating point of all, where one may witness the birth of the giants—the turbo-generator shop.

Here are built the Curtis turbines—the mightiest machines that man has ever put forth to quell the gods of earth. And this shop is worthy of them. It is the largest machine shop in the world—large enough to contain a three-ringed circus and a one-third mile running track besides. But the visitor is more amazed here than he ever was at the feats of the circus troupes.

Entering the building, we stood beside great disks—mills which revolved around us. At first glance one would take these

for entire machines in themselves; then, looking closer, one sees that on each mill reposes a massive disk of cast steel, and that on the upper surface of this disk one or two steel gravers are at work stripping off thin lines of the metal. After all, they are nothing but piece-machines, each turning out a certain portion of the work done on the tremendous castings. This is significant of the shop itself, for these towering machines are but magnified cutters such as may be seen at work in any smaller shop. Then we pass on, and our wonder becomes changed to awe.

Down the hall space over us swept a crane, bearing in its clutches a swaying mass of steel from the foundries, a mass 20 feet across, 40 tons in weight—a single casting. It stopped before us, dropped imperceptibly among other masses, and finally came to rest on a mill which would plane and purge it of all roughness. The wonder of the thing was that this mass of steel was lowered into place among wheels and turbines, missing some by a fraction of an inch, swinging back and forth but never touching any of the things around.

Over us towered these masses of steel, portions of the largest power units in the world. Beside us rose the field of a 30,000 horsepower generator, on which the cap had been lowered. I stepped through one of the openings in its side, and it was as if I had stepped into a house of metal, for men were at work all about me—working above my head at this single piece of steel.

Here were being placed the soft-iron punchings, in concentric layers all about the interior. To count these was an impossible task; dozens of them, pressed tightly together, all laid in by hand, all forming the same office that the little wires in an induction coil core perform, for this whole generator is but one mighty magnet itself.

Going on, it was hard to see much of the surrounding work. Walls of metal were all around, shutting off the view. One could peer through the spaces in these walls, seeing men and machinery at work on the other side, and the walls themselves were nothing more than small parts of the whole machine.

Other disk mills received the planed and formed disk castings for the steam operated element of the turbines, and placed around their edges the buckets, on which the turbine principle is founded.

The steel sectional flooring of the place reverses the usual shop process; it is specially constructed to bring the tools to the work, instead of bringing the work to the tools, for here the work is mightier than the tools or workmen. The tools, also, are easier to move and lighter to handle than is the work under construction, and this sectional flooring is used in all the larger shopbuildings.

The revolving blades of the turbine, which are sheared off roughly only, are milled and planed to the right thickness, and when the buckets have been bolted into position the blades are assembled on the shaft and the completed unit is set up in the rear of the shop for testing.

But a view from the "bays," far up in the top of the building, changes all this impression of magnitude. From here the workmen are dwarfed, together with their work. The giant disks and fields seem little things, and the 50-ton cranes pass us, swinging them easily and lightly from place to place. Here in these bays, at each side of the shop proper, is done the small work, the punchings and drillings that go to make up the whole.

As may be seen in the testing department, there is little or no friction to these great generators. The engine and rotary part of the turbine are put on the same shaft. When the steam is turned on this shaft spins like a top, revolving on its film of oil, governed as to speed by the governor above. The turbine whirls the generator at high speed, producing more electricity than any other type of engine, and a notable point of it is that there is no waste. The steam passes on down, losing some part of its velocity as it passes from disk to disk, and so on down

into the vacuum below, where it is condensed and drawn off, to be turned into steam again and sent back over its course.

And as the visitor leaves all this behind, too much impressed to even desire to see the rest of the place, too overwhelmed by the immensity of this one shop to care to spoil his visit by the memory of lesser things, what is the one thought he carries away? This, it seems to me, is the final test of these industrial institutions of ours; however great they may be, there is always one general impression which they leave with their visitors, a sub-conscious feeling.

This feeling, here, is one of contrast. The native of the district is too familiar with his surroundings to be impressed, but the visitor, who knows that here in the old days was the village of the Black Prince and the Great Swift Arrow, feels keenly that the survival of the fittest has given place to the survival of the most efficient. The entire world is in the thrall to Company Street. From Japan and Siam to Peru and Spain, from the Turanian to the Eurasian races, stretches the hand of power which has no limit and knows no master save the tiny brain of man. The farther we live from Nature, the more we must depend on the forces of Nature. The Indian revered these forces and stood afar off in worship. We, in his place, revere these forces equally—but we make them worship us.

GENERAL VIEW OF SCHENECTADY WORKS

A General Alarm for Telephone Systems

In manufacturing plants, public buildings and schools or other institutions which have private telephone systems or are planning to have such a system, there is frequently need for a device which will ring a number of bells or buzzers simultaneously. Such a device has been perfected by the Western Electric Company, in what they term "general alarm or code signaling sets."

The functions of the sets, which will probably find their greatest application in connection with private branch exchanges and interphone systems in business houses, factories, hospitals and schools, will be to call to the nearest telephone any one of a number of men by an arbitrary selective code, to sound an alarm in case of fire or other emergency and to sound bells for recess or recitation periods. The sets may also be used independently of telephone systems.

The signaling set may be mounted at any central point and bells and buzzers scattered wherever signals are to be given. A simple turn of a key handle will sound a call simultaneously on all the bells and repeat the call four times, each key sending out a different code signal. The sets can be connected into the telephone or interphone system together with an auxiliary resistance and condenser box. They are furnished in any capacity up to ten different signals.

Light: Its Use and Misuse

Under direction of the Illuminating Engineering Society a primer of illumination has just been prepared having for its purpose to assist the user to make artificial light effective. Through the courtesy of the Society photographs are here reproduced with accompanying extracts from this publication.—Editorial Note.

To see easily and comfortably you must select the lamps, fixtures and globes and arrange the lights so as best to suit the particular conditions which have to be met, but certain principles which must always be followed may safely be laid down. To understand these principles better let us see how the eye works. Figure 1 shows the parts of the eye as they would appear if the eye were cut through from back to front vertically.

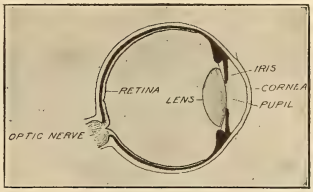


FIG. 1. A VERTICAL SECTION THROUGH THE EYE FROM BACK TO FRONT

In the process of seeing, the light passes through the cornea, pupil and lens of the eye to the retina just as in a camera light passes through the lens to the sensitized film. The picture is, therefore, formed on the retina, which is a layer made up of the ends of nerve fibers which gather into the optic nerve and go directly to the brain. The optic nerve sends along the picture to the brain for notice. The lens of the eye, unlike that of the camera, automatically changes in thickness to focus or make a clear image on the retina for seeing at different distances. This focusing action is called the accommodation of the eye and when the light is dim or bad the focusing muscle vainly hunts for some focus which may make objects look clear and gets tired in trying to do it. The muscles which move the eye about also get tired in the same way and the result is eye-strain, which stirs up pain and headache just as any other over tired muscles of the body may set up an ache.

The iris (which gives the eye its color) serves to regulate the amount of light which reaches the eye. In very dim light it opens out, making the pupil big, as shown at the left in Fig. 2, and in very bright light it shuts up as shown at the right, and thus keeps out a flood of brilliant light which might hurt the retina.

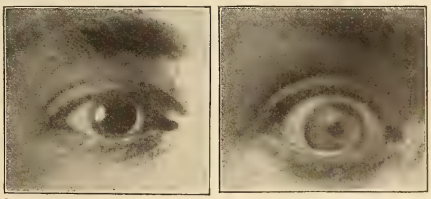


FIG. 2 ACTION OF THE IRIS IN WEAK AND STRONG LIGHT, MAKING THE PUPIL LARGE OR SMALL, AS THE CASE MAY BE

Judge the light you are getting by the way it helps you to see. Do not think because a lamp looks glaring and brilliant that it is giving you good light. It may be merely giving you too much light in the wrong place. On the other hand, a well shaded table lamp may look dim because it is well shaded and still be giving first class light for working purposes.

You must get enough light to see by and as you see things chiefly by the light which they reflect it is evident that dark colored objects which reflect light badly require more light than do light colored objects to see them comfortably. That which is quite sufficient for sewing on

white cloth, for example, will not do at all for working on black cloth.

See that your light is steady. If you leave a dark room and go into bright sunshine the sensation is unpleasant to the eye; if you use a light that flickers, you get this same unpleasant sensation even, perhaps, if the rapidity of the flickering is as high as 20 times a minute. Furthermore, the eye endeavors to adjust itself to suit the light. If the light flickers it keeps the iris of the eye "see-sawing," as it were, and the muscle that governs it gets tired and reacts on the nerves to cause discomfort and pain. Reading in railway trains causes similar strain; the eye muscles get tired of trying to follow the shaking page and may provoke a headache.

It is bad to have an unshaded brilliant light glaring into the eyes, for it throws hard labor upon them in an effort at adjustment. Figure 3 is an example of this. While artificial light may be made a good substitute for daylight, you have constantly to beware lest rays that are too bright, either from the lamps or from their reflections, hurt the eyes. You can get reflections so bright as to be harmful, from polished metal or glass, from bright varnished surfaces, or even from glossy white paper upon which the light falls as in Fig. 4.

A bright light fairly in the field of view means a very brilliant light on the retina, producing fatigue. Everyone knows the blinding sensation of looking at the sun with its sequence of dazzling colored images. Babies are common sufferers from this when careless mothers or nurses allow them to lie in their carriages with eyes exposed to the unclouded sun. Bright artificial lights in a less degree do the same thing to all of us.

FIG. 3. IT IS BAD TO HAVE AN UNSHADED, BRILLIANT LIGHT GLARING DIRECTLY INTO THE EYES. THIS IS A COMMON AND FAULTY ARRANGEMENT

From time immemorial mankind has received its light mostly from the sky. Consequently the part of the retina on which the light from above chiefly falls is pretty well used to it, while bright light from below falling on the part of the retina which commonly gets light only from grass or dark pavements, may be very irritating and unpleasant. Thus the glare from snow and sand is not only disagreeable on account of its intensity but because of the unusual direction from which it comes. Just so with a brilliant beam reflected from glossy paper on

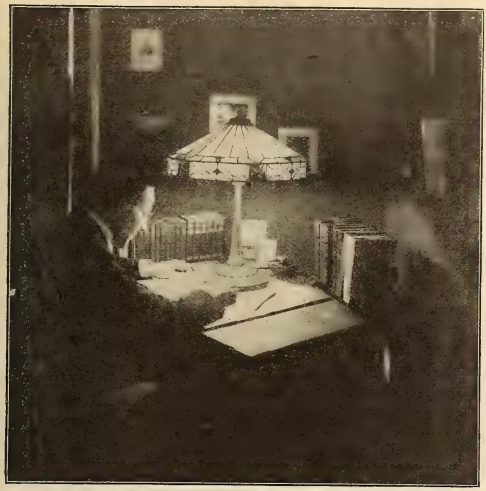


FIG. 4. A DAZZLING REFLECTION FROM GLOSSY PAPER MAY BE AS HARMFUL AS DIRECT GLARE FROM THE LIGHT SOURCE

which you are writing. Its rays strike you from an unusual direction and are harmful for that reason. Other smooth and shiny surfaces deliver an equally hurtful assault on that sensitive and much abused organ—the eye.

It is best to have the light come from above and somewhat sidewise, as it commonly does in nature, so that you will not get a brilliant reflection or glare from what you are trying to see. In reading and writing it is better to have the light come from the left, to avoid getting a shadow of the hand that holds the book or pen. Let the lamp be just far enough behind to keep direct reflections from the paper out of the eyes, Fig. 5.

By using reflectors you can put the light from a lamp where it will do the most good, much as an automobile headlight sends the light along the road just where it is wanted. An unshaded lamp does not throw the light where it is wanted. To ensure the light falling upon a table you must use a reflector that will bring it there.

Of such reflectors there are three general types, either of glass or of metal, which we may call concentrating, semi-concentrating and distributing. The three kinds are shown in Figure 6, from the top downward, respectively. The first acts almost like an automobile headlight, throwing its light

FIG. 5. THIS IS A GOOD POSITION FOR READING, AS THE LIGHT IS NOT REFLECTED DIRECTLY INTO THE EYES

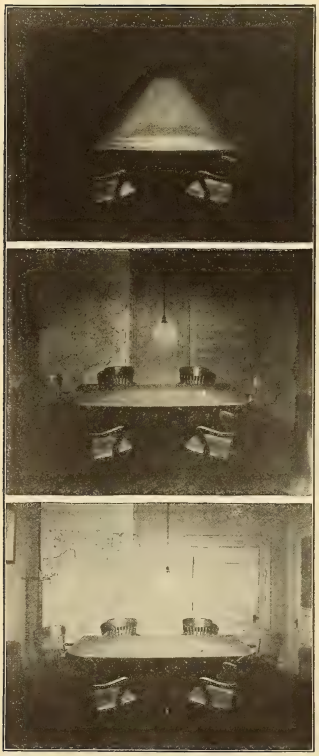


FIG. 6. ILLUSTRATING THREE TYPES OF REFLECTORS—CONCENTRATING, SEMI-CONCENTRATING AND DISTRIBUTING

downward into a comparatively small area. The second kind spreads out the light over a much wider area, of diameter perhaps as great as the height of the lamp above the table, while the third is planned to light a comparatively big area not very intensely at any one spot.

No reflector ever increases the total light that streams out of a lamp; it only puts the light where it is needed instead of letting it go unguided.

All reflectors should come far enough down over their lamps to prevent you from seeing the bright sources of light themselves without actually looking upward.

Because dark walls absorb light strongly instead of reflecting it they demand much stronger lamps for sufficient illumination than do light walls. A very dark wall paper or a dark wood finish may require three or four times as much light as a really light finish. Dark reds, greens and browns reflect only ten to fifteen per cent of the light which falls on them. White, cream color and light yellowish tints may reflect over one-half the light.

Likewise, deeply tinted globes and shades absorb much light—a fact which must be borne in mind in considering economy.

Dirt on electric bulbs, globes or reflectors absorbs and wastes much light. The country over, it is safe to say that millions of dollars are wasted every year by letting lamps become foul and dust laden. Nor is there any economy in using electric bulbs until they blacken. It pays to renew promptly blackened bulbs.

Saving light at the cost of the eyesight is false economy. To get good lighting it is generally necessary to diffuse the light from the lamps either directly by opal or ground glass shades, or indirectly by turning the light first on the ceiling or wall. The use of ground glass involves the absorption of fifteen to 20 per cent of the light to secure diffusion, opal glass of various kinds from 20 to 40 per cent while some forms of art glass and most diffusing ceilings absorb more than half the light that falls upon them. Even though all these appliances absorb light in the process of diffusion, there is gain in their use because they yield rays more grateful to the eyes. But your eyes may tire easily even with good lighting. If so, consult an oculist and don glasses if you need them. Eye-strain often comes from defective eyes as well as from faulty lights.

In a room suitably arranged for com-

FIG. 7. IN THE FIRST PICTURE THE BUST IS ILLUMINATED FROM DIRECTLY ABOVE. IN THE SECOND IT IS ILLUMINATED AS IT SHOULD BE—FROM ABOVE AND IN FRONT

fortable seeing, you may have plenty of light but the general effect may be displeasing. The illumination may quite fail to bring out the good points of the room in architecture and decoration, or may play pranks with the appearance of persons and things in the room as shown in Fig. 7 in the two illuminations of the marble bust. One may not object to ghastly tints in a factory, but in lighting a drawing room such effects would not be tolerated. Hence one often should sacrifice strict economy to get the most pleasing effect in the room. The fixtures that carry the lights should harmonize with their surroundings if the general effect is to be agreeable. Handsome fixtures have a decided decorative value whether their lamps are lighted or not. As strongly colored objects give something of their own hue to all the light which they reflect, the color of lamp shades, walls and furnishings plays an important part in the artistic effect.

Sentenced by Telephone

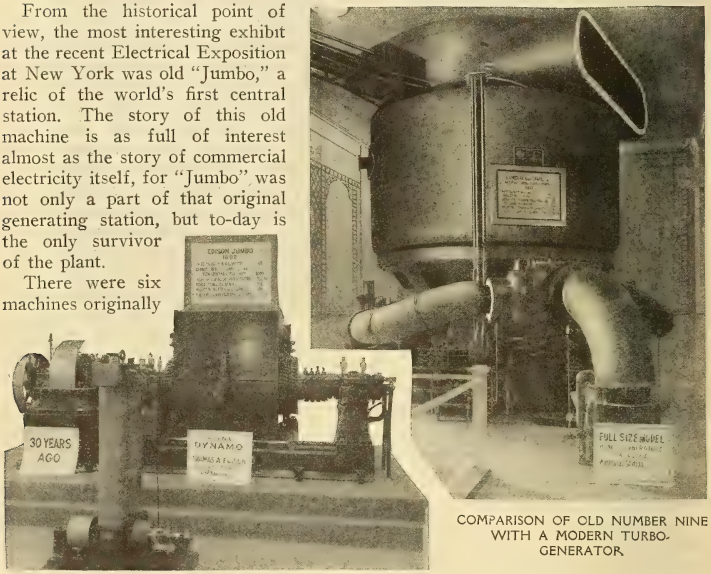
A rather strange court proceeding was held in California recently when a man was arrested, had his hearing, pleaded guilty to the charge and was fined, all without coming face to face with his accuser or judge, the long distance telephone being the medium.

While passing through the town of Red Bluff on his way to Chico, this man ran his automobile over a dog and killed it. A warrant was sworn out against him on a charge of exceeding the speed limit. When he reached Chico he was met by the sheriff who told him that he was wanted on the long distance telephone from Red Bluff. The man experienced a shock (not electric) when told what was wanted, but he pleaded guilty to the charge and was fined $35.00. If he had been made to telegraph the amount to the judge at Red Bluff it would have completed this strange "electric court," but he was only asked to hand it over to the sheriff.

Jumbo — A Relic of the World's First Central Station

From the historical point of view, the most interesting exhibit at the recent Electrical Exposition at New York was old "Jumbo," a relic of the world's first central station. The story of this old machine is as full of interest almost as the story of commercial electricity itself, for "Jumbo" was not only a part of that original generating station, but to-day is the only survivor of the plant.

There were six machines originally but five were destroyed by a fire that put the plant temporarily out of business. In 1895, outgrown and practically useless, the plant was dismantled, and the building sold. "Jumbo" is now a pensioner and is only shown on important occasions.



COMPARISON OF OLD NUMBER NINE WITH A MODERN TURBO-GENERATOR.

For this 30th anniversary of electric light in New York, the 125 horsepower machine was exhibited side by side with a full sized model of the very latest type of turbine generator, one rated at 30,000 horsepower.

Built in the old Goerck Street factory, where all the apparatus of the early Edison Electric Illuminating Company was constructed, this "Jumbo" generator was known as Number Nine. It was one of six machines designed especially for the Pearl Street station, the three earlier machines built at the factory having been shipped to London and Paris.

Number Nine, which was located near a window, was placed in operation at the opening of the Pearl Street plant in the afternoon of Sept. 4, 1882. In January, 1890, when fire destroyed the building and the other generators, this "Jumbo" was saved, but only because its position near the window enabled the firemen, who were on an elevated railroad structure to keep a stream of water on it. After this interruption, which lasted only a few days, "Jumbo" again went to work and continued until 1895, when the new Duane-Pearl Street plant was ready to relieve the outgrown central station of its burden.

Army Repair Shop on Wheels

One of the interesting features of the recent French army maneuvers was the use of a specially fitted power wagon of large size, which serves as a traveling repair shop and is used in connection with the aeroplane corps. The new car is equipped with an electric system for

FRENCH ARMY REPAIR WAGON

running the motor driven machine tools contained in the roomy quarters. When on the road it has the appearance of the usual closed power wagon, but when stationed on the spot at the aeroplane camp it is ready to be used for repairs, and the large side panels are let down so as to form a platform at each side of the car and thus add to the floor space of the workshop. Inside the wagon are a number of machine tools driven by small electric motors, such as lathe, emery wheel and forge, and there are also the necessary work benches for mechanics' or carpenters' use.

The wagon is run on the gasoline-electric plan, and has a powerful gasoline motor at the front part with a dynamo directly connected to it. In the middle of the truck are two electric motors, which drive the rear wheels by means of the current coming from the dynamo. This latter also gives the current for the workshop motors and the lighting.

Color Composition of Gas and Electric Lights

According to the familiar explanation, white is produced by a blending of the three primary colors—red, blue and green. Consequently, if we separate and measure the color components in any given source of light, the proportion of the primary colors will give us a clearer indication of how the light will affect whatever it illuminates. Such an analysis was recently reported to the London and Southern District Junior Gas Association by Mr. D. J. Winslow, of Lea Bridge, England. Taking the light at angle of 45 degrees with the axis of the lamps, both from an inverted gas mantle and from a tungsten lamp, Mr. Winslow found the color composition as follows:

	Electric	Gas
Red	58.1%	48.1%
Blue	13.1%	16.9%
Green	28.8%	35. %
Total	100%	100%

As every one knows, it is the red rays of a lamp that impart a warm or cheering glow to the light, while any excess of green gives a ghastly hue. The figures show why the tungsten lamp decidedly outstrips even a highly modern gas mantle lamp in the cheerfulness of its light. No wonder Mr. Winslow, in presenting these figures to a gas convention, added quite significantly: "The object of bringing this question of color composition of artificial lights before you is to point out the advisability of serious consideration of the matter; so that we may, if possible, be in a position to control the color of the light required, as this would undoubtedly lead to greater business."

Miniature Railway in a Steel Plant

A small industrial railway, little over 100 feet long, has been established at the plant of the Logan Iron and Steel Works, Burnham, Pa. An electric locomotive no bigger than a hand car is busy all day in its work of supplanting the horse for transporting iron and materials through this section of the plant. There is no trolley wire used in connection with the miniature system, current being collected by a shoe under the locomotive which follows a third rail in the middle of the track; and this rail is "dead" except during the time that the locomotive is passing over it.

This mill is much crowded with furnaces, machinery and rolls and the main thoroughfare for traveling through the plant is over the track equipped with this new system. The white hot iron from the furnaces on one side of the track is being continually transferred to the rolls on the other side. The rolls in turn shoot the hot, spitting bars back again across the track, giving the system two fiery baths from every piece of iron coming from the furnace. This process is repeated until the roadbed gets so hot in places that it becomes necessary to go to the other extreme and literally flood the track with water from a hose.

NOVEL INDUSTRIAL LOCOMOTIVE AND THE PATIENT ANIMAL IT HAS DISPLACED

There are nine

switches and cross-overs with seven spurs leading off from the main track over which the locomotive pushes the cars of iron to the furnaces. Each spur leads from the main track with a curve of fourteen feet radius. To cap the climax, it rounds four curves in a distance of 93 feet by the tape line.

The Eustis Turbine Windmill

W. E. C. Eustis, an engineer by profession, possesses a magnificent estate in the beautiful Blue Hills section, south of Boston, whereon is a complete electric equipment which is operated by an ingeniously constructed windmill. This cylindrical windmill is provided with a clever arrangement of fluted slats which catch even the slightest breeze. The wind enters the outer stationary cylinder through these curved pine boards and strikes an inner rotating cylinder containing oposite curves. It is thus a very close analogy to the Curtis steam turbine.

The inner cylinder turns a shaft which is connected with a dynamo in the little power house below. The current generated is carried by insulated wires to a 100 volt storage battery in the house. Sufficient current is available from the battery to light about 200 incandescent lamps on the estate, run a sawmill and pump water into a reservoir at the house.

The tower is said to be the largest of its kind in existence and an army of masons and steel workers was employed in its construction. The tower is supported by eight steel girders reaching 100 feet into the air to the base of the 50 foot wind cylinder at the top.

At the summit are arranged a number of scientific instruments including an aerometer. Every whim of the weather can be recorded.

Upon the ground at the base is the power house which contains the dynamo and instruments for registering watts, volts, amperes and wind velocity. At the power house a windlass can be put in operation that will control or stop the cylinder whenever desired. Upon the walls are numerous instruments which register every vibration from the wind and the amount of electrical energy sent into the big battery in the mansion. With each puff of wind one of the instruments scratches in red ink, upon a moving roll of paper, the report upon the air movements.

Although Mr. Eustis is employed as an expert by the huge Metropolitan Parks, Sewerage and Water District of

NOVEL CYLINDRICAL WINDMILL ON THE EUSTIS ESTATE

Boston and 30 surrounding towns and is occupied with engineering and business affairs when he is working, he makes this electric plant his plaything for amusement hours. And indeed it comprises a principle that could be made of vital importance in any community.

Although the Eustis tower has done an immense amount of work and furnished power to run dozens of machines upon an estate of scores of acres, the designer states that he has not as yet put it to its utmost capacity.

Miners' Electric Safety Lamps

Two kinds of accidents in coal mines—falls of the roof and the ignition of fire damp—have resulted in a movement for better safety lamps for miners' use and for better general illumination. That the electric lamp will be the future source of light is already asserted both in America and Europe.

In the recent international competition promoted by the British Home Office, England, for the best type of electric lamp for mines, the $5,000 in prize money was divided into nine parts. The first prize of $3,000 was awarded the Ceag lamp and eight prizes of $250 each were awarded other lamps of merit.

TYPES OF MINERS' SAFETY LAMPS

In the illustration is shown an American miner's electric lamp mounted on the cap for service so that the miner is in no way hindered in his work, while above and to the right it is shown as a hand lantern.

The light is brighter than that of the oil lamp and is steadier. The outfit is also cleaner, there being no filthy smoke and no dropping of oil. The battery will last for twelve hours and it can then be recharged overnight. Its weight is two pounds and the battery carried on the belt in no way interferes with the wearer's freedom in his movements, whether he uses a pick, a drill or a shovel.

The prize winner, in the center of the picture, and a close competitor, the Stach safety lamp, are here shown. The Ceag lamp was invented by a German coal miner. The lamp consists of three parts—the accumulator and the bottom and top parts—and weighs a little over four pounds. It is so strongly constructed that it may be thrown onto a stone floor

without receiving any serious damage and this experiment was repeatedly made during the practical trials carried out by the judges.

The lamp is a metal filament lamp of 1.5 candlepower and burns after charging—which takes four to five hours—continuously for a period of sixteen hours. The lamp bulb is protected by a thick glass dome in a cage of four iron rods and is placed between spiral springs which take up any shock due to a knock or violent vibration and hence it is not so liable to damage as bulbs rigidly held in position. The chief advantage, however, of this arrangement is that it ensures absolute safety against igniting firedamp, as should this protecting bulb become broken the electric circuit breaks automatically.

The Stach lamp consists of a cylindrical wrought iron welded case, carried on trunnions in a stirrup handle which is at the top provided with the usual spiked iron hook for the purpose of suspending the lamp by driving the hook into a wooden prop during work. The accumulator consists of a two volt, round, semi-dry, lead accumulator in a celluloid case. The lamp gives two candlepower and after charging will burn for a period of fourteen hours. The accumulator should be charged with a current of 1½ amperes for twelve hours. Its weight, however, when ready for use is about six pounds, which is a serious objection.

It may be well to remember, however, that the oil lamp gives the miner warning of the presence of bad air by the way it burns. The electric lamp, therefore, should have added to it a device that will detect the pressure and amount of the dangerous fire damp, thus giving the miner a chance to get away and give warning.

"Our colonies might be well enough," was a saying among Englishmen in 1774, "were it not for Dr. Franklin, who has, with a brand lighted from the clouds, set fire to all America."

Pursuit of the Nitrogen Atom

Wherever the investigator turns the nitrogen atom is found either for good or evil. It is the most restless and powerful of all the elements and its activities predominate in its many combinations which have given us our most delicate perfumes, our thousands of colors in the aniline dyes and the hundreds of synthetic medicines. It is the reigning power in a host of deadly poisons and ptomains, a constituent of violent explosives, dissolves the metals in the arts, extracts gold from the ores and in many ways contributes to the welfare of mankind.

The perfecting of the process of making calcium cyanamide or "kalkstickstoff," as the Germans call it, by liquid air and the electric furnace has led electrochemists into new territories and the energy of the furnace has perfected many new processes in the field of chemistry alone.

When the calcium cyanamide is fused in the furnace with sodium carbonate or common salt, the cyanamide forms cyanide of soda, which is used in silver plating, gold extracting and for other metallurgical uses, while cyanamide itself is being extensively used in case-hardening of steel, producing a superior article. Another substance produced by the action of acids on cyanamide is used in the dyeing industry and contains 66 per cent nitrogen. It is also used in the manufacture of explosives as it has the property of lowering the temperature in the barrel of the gun.

Through all these processes we see the elusive nitrogen atom garnered by the genius and ingenuity of the electrochemist and his methods made commercially possible primarily by the electric furnace. The future of this element as related to the needs and uses of mankind is hard to forecast. No other element has the tendency to "fly off the handle" as has the nitrogen atom and the slightest disturbance will send it flying from one community of atoms to another.

Behind the "Scenes" in a Moving Picture Theater

By BENNETT W. COOKE

As you sit in a moving picture theater and watch the unfolding of a quarter of a mile of film upon the screen you are aware that if you were to follow the beam of light back into the little house in the rear of the room you would come to the source of the pictures, the films themselves. But very few, comparatively speaking, ever get to see that source, just as comparatively few ever get back of the scenes in the regular theater. Realize, then, that in this little house of the moving picture operator some wonderful advancements have been made in the last three or four years—you have a hint of this in the improved appearance of the pictures that stand before you on the screen with scarcely a perceptible tremor. What was once a little box-like inferno, containing little else than an improved form of electric furnace for roasting operators while they slowly cranked the films and, as Poe would put it, "Muttered and mumbled low," has now become, in the better class of theaters, a spacious room, well ventilated and with an electrical equipment to compare favorably with that on the regular theater stage.

To begin with, instead of inexperienced men operating the moving picture machine the operator of to-day must first prove his ability not only to operate the machine but to meet with any emergency that may arise. In the larger cities before a man is allowed to become an operator he must first pass a rigid examination given by the city.

In order to understand something of the nature of the task which an operator undertakes and the conditions under which he works, no better method presents itself than to make a "visit" behind the scenes in one of the modern theaters as, for instance, the Kedzie Annex Theater, recently completed in Chicago, with a seating capacity of 800.

The walls of the booth, shown in Fig. 1, are built entirely of hollow tile, plastered, and it has a cement floor. Not a piece of wood is used, either in the construction of the booth or in connection with the apparatus. Every possible means for the prevention of fire has been adopted. The small openings in front of the machines have doors which slide up and down and are held up by a piece of cotton twine. This twine is run through loops on an arm fastened to the wall and extending out over the front of the machine. The twine is then brought down and fastened to the machine near the place where the light strikes the film. If the film catches fire this twine burns and the doors will be released and drop down in front of the openings.

On the rear wall of the booth is a telephone which connects the operator with the ticket office, manager's office and the stage. In this rear wall is also an opening about two feet square to the fresh air inlet. An electric fan at this opening furnishes the booth with fresh air, the impure air leaving by a ventilator in the ceiling which is connected to the exhaust fans.

The machine at the extreme left is the spot light; its purpose is to throw the light on the vocalist. The two machines in the center are used to project the moving pictures and the machine at the right is the dissolver, used for projecting the song slides. The two gauges on the wall between the doors are called ampere meters and show the strength of the current used, which determines the strength of the light. The operator watches these meters to gauge the strength of his light.

It will be noticed that the dissolver for the song slides has two houses; each contains an arc lamp and is called a lamp house. There are a number of handles projecting from the rear of each lamp

house. By means of these handles, the carbons in the lamp can be adjusted to and desired position. By looking through a small colored glass window in the side of the lamp house the operator can see just what position the carbons are in while the machine is in use. In front of the lamp house are the lenses that project the pictures on the screen and the song slides are placed between these lenses.

When the slides are to be projected both lamps are lighted. A slide is put in the upper carrier and projected on the screen. The next picture to be projected is put in the lower carrier in front of the lower lamp. By pulling a lever a shutter gradually closes over the upper opening and at the same a similar shutter draws away from the lower opening allowing the lower picture to be shown on the screen and the effect produced is of one picture dissolving into another.

The two center machines are for the moving pictures and are used alternately. By having two machines the assistant can get one in readiness while the operator is using the other. And if one should break down, they could rely upon the other. The two circular metal cases on the front of the machine contain the reels upon which the film is wound. These are called the "magazines" and there is no solder used in their construction, the seams being bent and fastened with rivets so that in case of fire the magazines will not fall apart and expose the film.

Each reel contains about 1,000 or more feet of film consisting of one or more subjects. The reel is first placed in the upper magazine and is threaded over various rollers and sprocket wheels and fastened to the empty reel in the lower magazine. The film consists of a narrow strip of celluloid composition 1¼ inches wide, the pictures being one inch wide and three-fourths of an inch long. The film is pulled down by means of a sprocket with teeth. These teeth fit into sprocket holes on both sides of the film.

The light strikes the film at one place

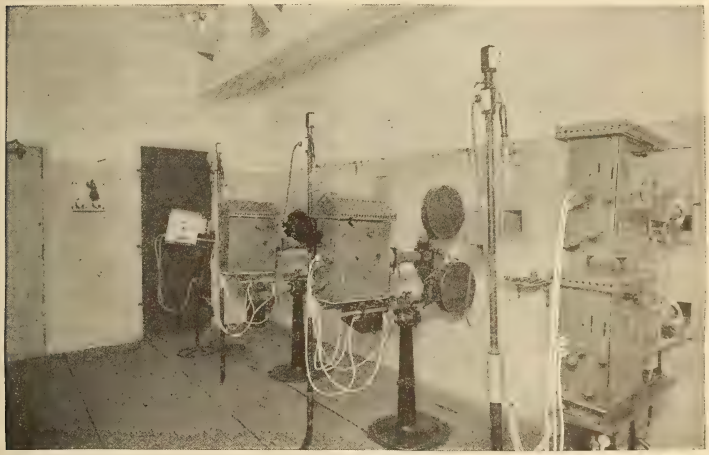


FIG. 1. NOT A PIECE OF WOOD IS USED IN THE CONSTRUCTION OF THE MODERN MOVING PICTURE OPERATING BOOTH

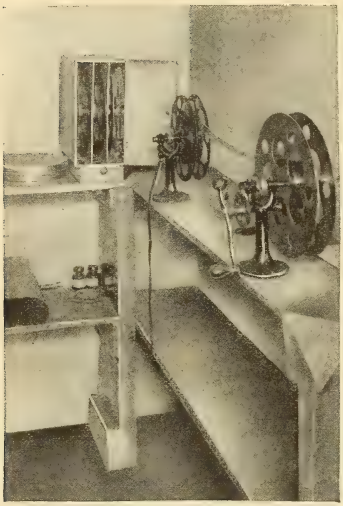


FIG. 2. IN A SEPARATE ROOM THE FILMS ARE REWOUND AND STORED

only. It passes from the lamp house through two large lenses then through the tube that can be seen between the lamp house and the head of the machine: It then passes through the film, through two more sets of lenses and to the screen or curtain. The light is never allowed to strike the film unless the film is in motion (at the rate of sixteen pictures a second) as the film is highly combustible and would catch fire instantly.

There is a concern that makes fire proof films but as yet there are very few on the market although nearly all are waterproofed.

Each picture as it comes in front of the light stops there for an instant and is projected on the screen. The light is then cut off for an instant by means of a revolving shutter and the next picture is brought in front of the light. This picture is in turn projected upon the screen as the shutter moves away and allows the light to pass. This of course is done so rapidly that the spectator cannot distinguish the intervals between the pictures. If it were not for this shutter there would be nothing but a blur on the screen. It is very evident from the above explanation that the picture on the screen does *not* move at all but is merely a rapid succession of perfectly stationary pictures. Thus the modern moving picture is really an optical illusion.

These machines are operated by hand in Chicago, motors not being allowed for fear the operator will leave his machine and the film catch fire in his absence.

When the films have been run through the machine, they must be rewound before they can be used again. Figure 2 shows a separate room adjoining the operating room that is used for storing and rewinding the films. This room is fire proof throughout and on the table may be seen a galvanized iron box large enough to hold three reels, the number used each day. In the same case underneath the reels is a compartment filled with a liquid. Holes are made in the top of this compartment which allow moisture to reach the reels, thus keeping them soft.

On the same table may be seen the rewinding apparatus with a film partly rewound. In most places the films are rewound in the same booth with the machines, in this case the reels must be enclosed in metal magazines and not more than two feet of film exposed at any time.

Every film shown in Chicago must be first passed on by the chief of police or one of his assistants as to its moral character and a permit is issued to accompany the film. The permit sometimes states to cut out a certain scene that is deemed objectionable and this must be done by the film exchanges which rent the films to the theaters. When the operator takes his three reels from the exchange he must also take the permits for the reels and if a permit states that a certain portion be taken out the operator must see that it has been taken out be-

fore he starts his show, for if he is caught showing a reel without a permit or one from which the objectionable part has not been removed he will lose his license and will not be allowed to operate again in the city and the reel cannot be used again.

When the picture stops suddenly on the screen the film probably has broken. The film tears easily and a small rough spot on the film is very likely to catch as it passes through the machine and tear the film apart. When this happens the most up-to-date operator does not stop to cement it together but simply brings the broken end down to the lower magazine, slips it under the other end, threads the film into the machine again and proceeds with the picture. After the film has been run through the assistant rewinds it and then patches it where it is broken. This is done by cementing the two ends.

The reader has probably noticed that the picture will be running along smoothly when suddenly a line will be seen across the picture and above the line will be seen the lower half of a picture, below the line will be seen the upper half of a picture. This is caused by not patching the film properly. Between every two pictures is a line. When patching the film properly one line must come exactly over another. When the picture jumps this way on the screen the operator must "frame" the picture. This is done by moving a lever which adjusts the picture so that it is exactly framed by the aperture. The aperture is a hole just the size of a picture, through which the light passes immediately after going through the film.

Figure 3 shows another room adjoining the operating booth. This room contains the switchboard and two mercury arc rectifiers. The operator here controls every light in the house except the emergency lights.

Besides his own apparatus he controls the stage pocket lights, electric exhaust fans, electric house fans, electric organ and the house lights.

The two machines beyond the switchboard are called mercury arc rectifiers. These are used in connection with the moving picture machines to change the usual alternating current to direct current which is best for operating the arc lamps.

When the operator is running his last reel for the evening his assistant gets the dissolver in readiness. As soon as the reel is finished a "Good-Night" slide is projected upon the screen. The operator now rushes to the switchboard and turns on the house lights and the show is over.

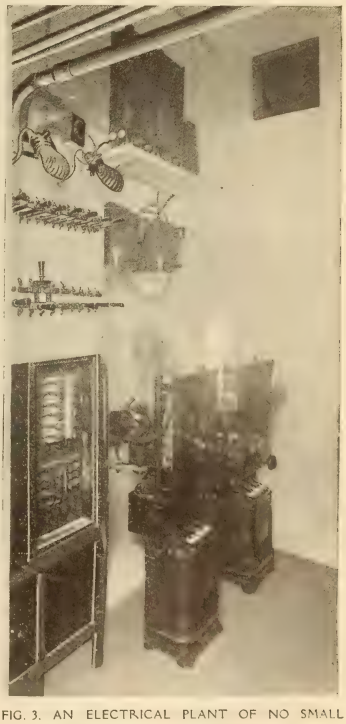
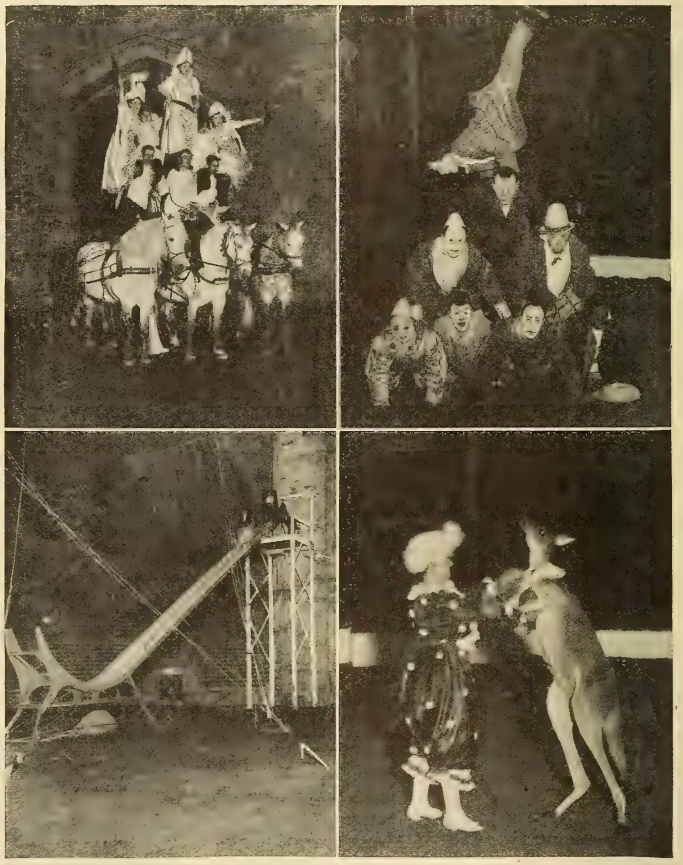


FIG. 3. AN ELECTRICAL PLANT OF NO SMALL PROPORTIONS IS AN ADJUNCT OF THE MODERN MOVING PICTURE THEATER



ARC LIGHTS AND HIGH CLASS PHOTOGRAPHY

The photographs from which the above illustration was produced were taken at Earls Court, the famous London amusement resort. No flash light was used in making the exposures which were made under the illumination of powerful arc lamps. Unusual sharpness of detail was obtained which is partially brought out by the halftone reproduction. Taken in order the subjects are as follows: Equestrian act; acrobatic clowns; looping the loop with a tandem motor car, and the boxing kangaroo.

Modern Underground Work

Less than twenty years ago, the streets of all great cities were encumbered by the rows of high poles that lined each curb, and often were actually darkened by the clusters of telegraph, telephone, arc light, burglar alarm and stock ticker wires. There was practically no legislation regulating the erection of these poles or the stringing of wires, and there was no way even to compel the operating companies to remove useless wires or to protect the public from broken ends which dangled over the sidewalks. In the business districts the poles often reached to the tops of the highest buildings, and as there were sometimes fifteen or more cross arms on each pole and each arm supported ten wires it may easily be seen how they overshadowed the street.

Somebody once remarked that they would make a most effective fire-escape, if only the fire trapped person who jumped among them was fortunate enough to land on one of the dead wires.

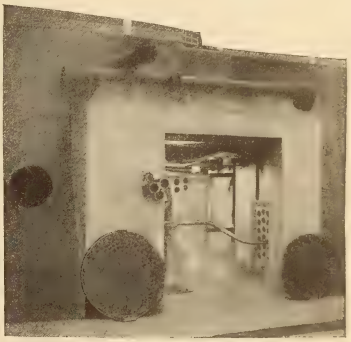
The beginning of the end of this overhead method of construction came when the Edison Electric Illuminating Company, under the direction of Thomas Edison, laid out the distribution system of the world's first commercial central station —underground.

Even the underground system had its critics, and it is recorded that some one remarked that while most companies were satisfied with all the air, Edison only wanted the earth. Edison generally answered such criticisms by asking why the gas and water mains were not put in the air on stilts.

However, the underground conductors were extended through about fifteen miles of streets in a territory a mile square.

The old conductors were quite different from those of the present day, for instead of a cable a hundred or more feet in length, the wires were put down in twenty foot sections, which had to be welded together. These sections consisted of iron pipe in which three copper rods had been placed and into which an insulating compound had been forced to completely fill the pipe.

Some of those old iron pipes with their copper rods are still in service in New York, but as the newer method of underground distribution is being extended, sections are being replaced. Some of this old material that has been dug from the streets was exhibited at the recent Electrical Exposition in New York by the Consolidated Telegraph and Electrical Subway Company.



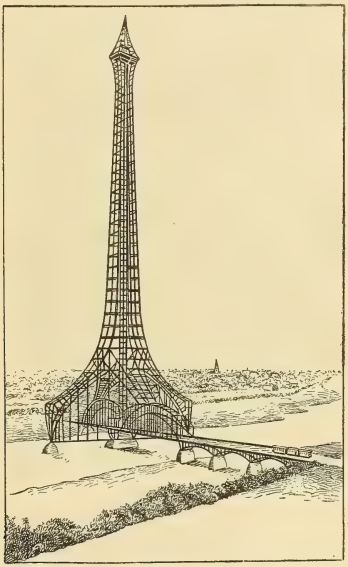
A MODERN CABLE VAULT

This company builds the underground ducts in which the present day cables are laid and at their display they showed a street cross section, the exhibit consisting of a man-hole, the clay ducts, the pipe galleries, and the adjacent gas and water mains. This showed how the cable is drawn through the ducts under the street, thus eliminating the necessity of tearing open the thoroughfare every time a repair is needed.

It has been estimated that there are close to three thousand miles of electrical subways in New York, yet even with this vast underground system there are still poles on some of the streets, just as the horses are still doing service on some of the car lines.

Plans to Outdo the Eiffel Tower

A German engineer, M. Czech, of Düsseldorf, has brought forward a project for a structural steel tower which will be the highest in the world, higher even than the Eiffel Tower at Paris, which now holds the record. It will be no less



TOWER 1600 FEET HIGH CONTEMPLATED TO SPAN THE RIVER RHINE

than 1,600 feet in height (the Eiffel Tower is 984 feet) and aside from this feature it has a very original construction from the fact that it is designed to span the Rhine. It is intended to be used for wireless telegraphy and no doubt the mesages sent from a tower of so great a height would carry for unheard-of distances.

According to the plans the base of the tower is a steel bridge having two long spans of 650 feet as well as several shorter spans. The tower rests partly upon the bridge piers and partly upon two extra piers which are built in the river at the sides of the bridge, these latter piers being 650 feet apart. From the four supports, the base part of the tower rises in the form of an arched construction 315 feet high and from here the structure narrows and continues to the top in a tapered form, as will be noticed. Near the top is an upper platform 160 feet below the extreme summit, this platform being about 80 feet square. Should the project be carried out and a wireless station be built in connection with it, some interesting results may be expected.

Telephoning Through the Tow Line

An invention to make possible telephone communication between a tug boat and the vessel which it is pulling by a

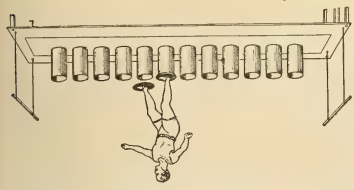
A TELEPHONE WIRE IS EMBEDDED IN THE TOW LINE

tow line has recently been patented by Robert H. Lindal, Gloucester City, N. J.

The telephone circuit consists of a single wire preferably spirally laid within the tow line which at each end has terminals for flexible wire connection to each pilot house. The other side of the circuit is formed through the water by grounding each end of the line upon a metallic plate on the outside of the hull.

Vacuum Act

Theatrical apparatus to enable a performer to walk, head downward upon the ends of a series of hollow cylinders



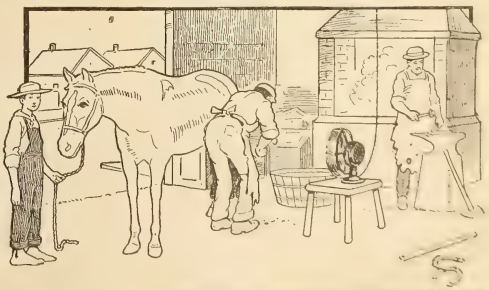
SUSPENDED HEAD DOWNWARD FROM VACUUM CYLINDERS

fastened to a temporary ceiling high above the stage floor is the subject of a patent granted to John W. Frakes, Chicago, Ill.

The cylindrical air chambers are all connected by piping to an air pump. The pipe to each chamber is equipped with a valve controlled by an electro-magnet from which wires run behind the scenes to a keyboard. The performer wears upon his feet disks of heavy leather fitted with pliable material such as rubber or felt. From the trapeze bar he places one foot upon the nearest air chamber while the operator at the keyboard causes the electro-magnet at that particular air chamber to open the exhaust pipe to the pump. A vacuum is formed. When the next step is taken air is admitted to the first cylinder while a vacuum is formed at the second.

Fan in Blacksmith Shop

An electric fan placed on the floor a few feet away from the blacksmith as he fits and fastens the shoe upon the horse's foot blows the fumes of the hoof away and in summer scatters the flies. The horse so protected is comfortable and easier to handle.



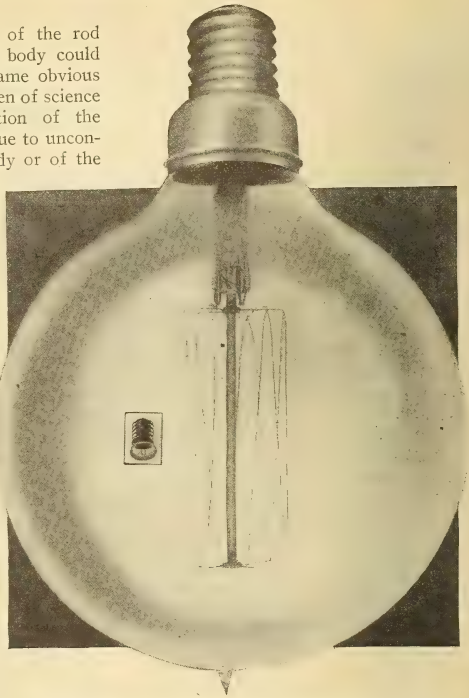
THE HORSE IS MORE COMFORTABLE AND EASIER TO HANDLE UNDER THE FAN'S INFLUENCE

The Divining Rod

The United States Geological Survey, in Water-Supply Paper 255, entitled "Underground Waters for Farm Use," just reissued, states that no appliance, either mechanical or electric, has yet been devised that will detect water in places where plain common sense and close observation will not show its presence just as well. Numerous mechanical devices have been proposed for detecting the presence of underground water, ranging in complexity from the simple forked branch of witch hazel, peach or other tree to more or less elaborate mechanical or electric contrivances. Many of the operators of these devices, especially those who use the home cut forked branch, are entirely honest in the belief that the working of the rod is influenced by agencies—usually regarded as electric currents following underground streams of water—that are entirely independent of their own bodies, and many people have implicit faith in their own and others' ability to locate underground water in this way. In experiments with a rod made from a forked branch it seemed to turn downward at certain points independent of the operator's will, but more complete tests showed that this downturning resulted from slight and, until watched for, unconscious muscular action, the effects of which were communicated through the arms and wrists

to the rod. No movement of the rod from causes outside of the body could be detected, and it soon became obvious that the view held by other men of science is correct—that the operation of the "divining rod" is generally due to unconscious movements of the body or of the muscles of the hand. The experiments made show that these movements occur most frequently at places where the operator's experience has led him to believe that water may be found.

The uselessness of the divining rod is indicated by the facts that it may be worked at will by the operator, that he fails to detect strong water currents in tunnels and other channels that afford no surface indications of water, and that his locations in limestone regions where water flows in well-defined channels are no more successful than those dependent on mere guess. In fact operators are successful only in regions where water occurs in a definite sheet.



THE LARGEST AND THE SMALLEST INCANDESCENT LAMP

Brobdingnag and Liliputian

Something of the wide variation in the size of tungsten filament lamps is shown by comparison in the accompanying illustration of one of the largest and of one of the smallest lamps regularly manufactured by the lamp division of the General Electric Company.

The globe of the big one is eight inches in diameter and the lamp is 11¾ inches over all. The bulb of the little one is only 7/16 of an inch in diameter and the length of the bulb and base together is 23/32 of an inch. The giant is a 500 watt lamp made for voltage ranges of 100 to 130 and 200 to 260. In the 100 to 130 volt type it operates at an efficiency of one watt per candle, giving a candlepower of 500. In the 200 to 260 volt type the efficiency is 1.23 watts per candle giving 405 candlepower. The life of this lamp up to the point where the candlepower drops to 80 per cent of the initial candlepower is 1,000 hours. The filament is of drawn tungsten wire and is extremely strong as compared to the former pressed filament lamp.

The filament of the small lamp is also of drawn tungsten wire and has a total life of eight hours. At 2½ volts it gives one candlepower and requires 3/10 of an ampere of current.

ILLUMINATED SEMAPHORE SIGNAL

Realizing that the man in the cab must often strain his eyes and have a feeling of uncertainty as to whether the semaphore arm at night or in a fog stands at "stop" or "clear," Arthur H. Fargo, Newark, N. J., has recently secured a patent on an illuminated semaphore signal. In the illustration the arm stands outlined by the Moore vacuum tube light in which rarified gas in the tube acts as a conductor and is rendered incandescent by electric current.

Electric Ghosts

In an address to electrical engineers in London a distinguished scientist thus defined an electron:

An atom is ordinarily associated with a charge, and force is required to separate the charge from the atom. The atomic charge when separated is called an electron. In an electrolyte, i. e., a substance decomposed by an electric current, there is a bodily transfer of atoms with their charges; in a metallic conductor the charges are handed on as electrons from atom to atom. In the discharge through highly rarefied gases the electric current is in its most simple form, for here there is a flow of electrons travelling by themselves, of disembodied charges or electric ghosts. Electrons, it should be added, are the fastest moving of all known terrestrial objects, their speed being one-tenth that of light, which is 186,300 miles per second.

Lights Send Children Home

To remind the children who are on the streets at night that it is getting late and time to go home the Los Angeles police juvenile officer has suggested what he calls a "skip home" signal, to the chief of police.

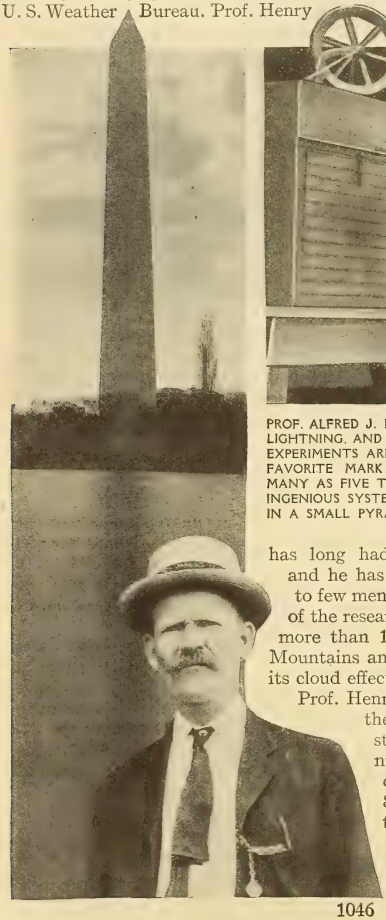
His plan is to have the electric lights flash shortly before nine o'clock as a warning and promptly at nine to have the lights turned out for a few seconds so that these children will not have the excuse of being ignorant of the hour.

This plan will probably be adopted as a large number of very small boys who sell newspapers are in the habit of remaining out until late in the night even after their stock of papers have been disposed of.

Uncle Sam Investigates Electrical Disturbances

By WALDON FAWCETT

Such investigation of lightning and electrical disturbances as has been carried on for the United States Weather Bureau has been conducted by Alfred J. Henry, professor of meteorology in the U. S. Weather Bureau. Prof. Henry



PROF. ALFRED J. HENRY, THE WEATHER BUREAU'S EXPERT ON LIGHTNING, AND THE MT. WEATHER OBSERVATORY WHERE HIS EXPERIMENTS ARE MADE. THE WASHINGTON MONUMENT IS A FAVORITE MARK FOR LIGHTNING, HAVING BEEN STRUCK AS MANY AS FIVE TIMES IN 20 MINUTES. IT IS PROTECTED BY AN INGENIOUS SYSTEM OF LIGHTNING CONDUCTORS TERMINATING IN A SMALL PYRAMID OF ALUMINUM.

has long had instinctive interest in the subject and he has opportunities such as are vouchsafed to few men for studying lightning, being in charge of the research work at Mount Weather, a peak of more than 1,700 feet altitude in the Blue Ridge Mountains and in the heart of a region famous for its cloud effects and severe electrical storms.

Prof. Henry says that he is convinced that were the subject of lightning better understood there would be a reduction in the number of persons killed from this cause, a mortality that totals 700 to 800 persons annually, in addition to twice that number injured by lightning. He also emphasizes the fact that the great increase in recent years in the number of electrical light and power

transmission lines has stimulated the development of means of protection so that nowadays the electric power plants and lines are better protected from lightning than are the average farm buildings.

Speaking for the benefit of rural and suburban residents Prof. Henry says that he is confident that while absolute protection cannot be secured unless the building is incased in a network of wires he is confident that a building with a properly installed system of lightning conductors will fare better than one without such a system if a discharge of the most violent type should fall upon it. He also urges that wire fences be grounded at every fifth post, the galvanized ground wire extending at least two feet into the earth. As for lightning conductors on buildings, particularly farm buildings, the Weather Bureau expert holds that in a general way, a terminal 20 inches long should be erected every eighteen or 20 feet along the ridge of the roof, in addition to short terminal wires on each cupola, chimney or other salient point on the roof liable to be struck.

According to all the governmental investigations, lightning (a violent discharge of electricity either between one cloud and another, between a cloud and the earth, or between two strata of air differently electrified) is commonly assumed to discharge from a higher to a lower level although it may be from either or both. Clear air, it has been found, is, as a rule, electrified positively but in rain the electrification ranges from a high negative to a high positive although it is more often positive. During a single storm the air may change back and forth several times from a positive to a negative condition and the difference in potential between the earth and a point ten feet above it may amount to hundreds or even thousands of volts.

Up to date no one of the scientists has been able to determine the exact nature of a lightning flash. Experiments with kites have shown the varying potentials between air strata and there is the general theory that electricity flows from a positive to a negative body, but for all that there is evidence that a lightning discharge is in most cases pulsating. It is claimed that a lightning stroke differs according to the direction of the flash and as to whether the earth is positive or negative. The violence of a discharge and its effects are matters of pressure or tension, say between the earth and a cloud. There may be an adjustment of potentials following a discharge.

The lightning experts some time ago discovered that most flashes are composed of several discharges following one another at certain intervals in the path made by the first discharge. This is the line of investigation which the Smithsonian Institution is following by means of grants from the Hodgkins Fund. It has been ascertained that a flash may be composed of anywhere from fourteen to 40 separate discharges and not only is what appears to the naked eye as one flash in reality a number of parallel flashes but the flash has width like a ribbon. The Smithsonian Institution is also endeavoring to time the duration of lightning flashes. Meanwhile at the Harvard College Observatory attempts are being made to photograph the spectrum of lightning.

With linear lightning making up the first general class we have as a second class ball lightning or, as it is sometimes called, fire ball or globular lightning. The balls vary in size from a half inch to several feet in diameter and they also differ in motion from linear lightning being possibly even more erratic. Ball lightning is not however to be confounded with St. Elmo's light, a blue or red electric discharge sometimes seen on the masts of ships and more rarely on church spires.

In their observation of lightning flashes and tests of lightning conductors the Federal experts have found an ideal testing station in the Washington Monument.

The famous obelisk is struck by lightning a number of times every year but no havoc has ever been wrought, thanks to an ingenious system of lightning conductors, the keynote of the installation being found in a small pyramid of aluminum weighing about 100 ounces, which crowns the capstone of the monument. This headpiece is connected with rods that descend 600 feet to a well sunk to a considerable depth below the level of the earth. The monument has been visited by as many as five electric bolts within an interval of 20 minutes but the protective system has always proven equal to all the exactions imposed upon it.

Hints on Using the Long Distance Telephone

To use the long distance telephone there are some rules that will be of value in making the minutes count for something, in making the hearer understand readily and in disillusioning ourselves of the horror that is sometimes noticeable in speakers, even when talking over a local telephone.

There is, or there should be, a reason for calling one on long distance. The subject matter should be well in mind first, and the exact nature of the questions should be either in mind, or written down as carefully as possible. Every minute counts in this way, and there is so much lost in these calls by inexperienced people that the real value of the telephone loses some of its charm for them.

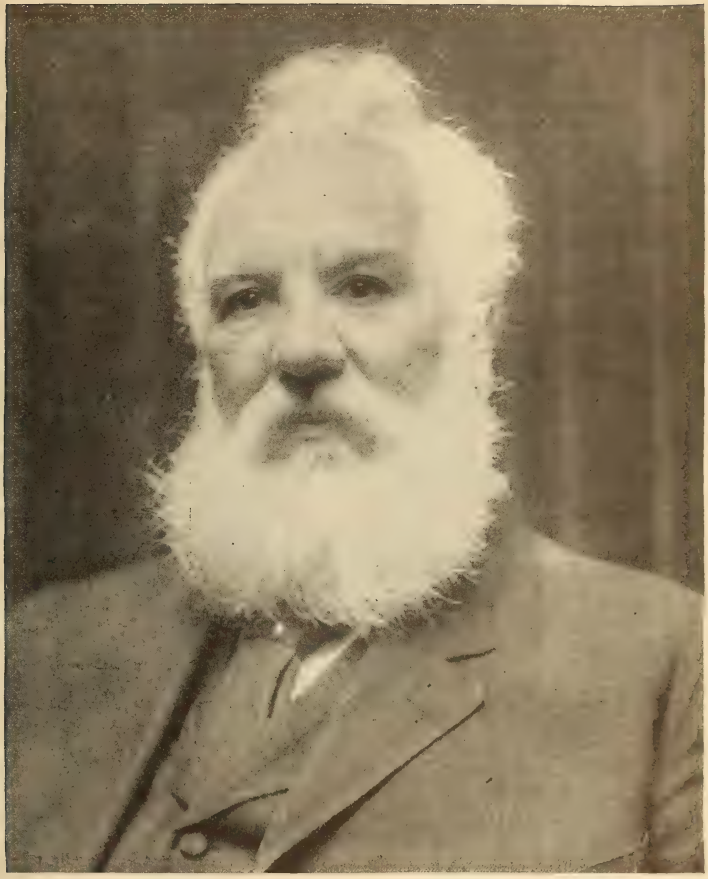
When the subject and the questions have been clearly grasped and put in order, there must be composure of mind to insure both being heard and hearing. Talking in a moderate tone, speaking with slowness and distinctness and giving the hearer ample time to grasp the meaning of each word, brings satisfactory results. You are simply talking to your friend or neighbor, or business acquaintance, and the matter must be treated as an every day occurrence. The person who becomes excited or who lets his nervousness get the better of him has accomplished little toward a realization of the object desired.

Use some little imaginary power in this case. Consider that the person with whom you are speaking is but a few feet distant. Bring the personality into the subject, and there will at once arise a feeling of complacency and an ease of conversation that will be surprising. So many, in using the long distance telephone, forget that it is the same as the local telephone save that the distance is greater. The voice is just as easily understood and the feeling of a personal conversation should not be less so because you are conscious of a greater distance.

There is so much simplicity and such sure satisfaction to the user of the long distance, provided he has first given that consideration to the matter that it justly demands. It may be the fact that there is a certain sum invested that he feels should be made to produce something tangible that arouses his feelings of anxiousness and concern; and that, in reality, is the real secret of his unsatisfactory service.

There are but a few simple rules to follow in the use of the long distance telephone, and these are applicable to the local telephone as well. A cool head; a clear voice; a definite object in using the instrument; a plan of questions to be asked and the elimination of unnecessary words. Time is a factor that should be considered.

If, therefore, we adopt and follow a few well defined rules there will be a feeling of satisfaction and a conscious gratification in the use of the long distance telephone that will amount to many dollars in both time and temper, and save a loss in other ways that is common to the man who does not understand the disadvantage of talking with a meaningless jargon and a lack of true value of this modern instrument of distance annihilation.



DR. ALEXANDER GRAHAM BELL

This photograph of Dr. Alexander Graham Bell, inventor of the telephone, was taken approximately three years ago and is the latest picture obtainable, as well as the one preferred by him for publication. It was sent to us through the courtesy of Mr. Ernest Gregory, editor of the *Volta Review*, which is the magazine published by the American Association to Promote the Teaching of Speech to the Deaf. Dr. Bell was the founder and first president of the association and his present activities are principally along the line of this work.

The Master Organ Builder

Robert Hope-Jones and his Unit Orchestra

By ARTHUR H. MILLER

It will be remembered that in the May, 1912, issue of this Magazine a brief description was given of the Unit Orchestra, the invention of Robert Hope-Jones, referring particularly to the trial installation in the Cort Theatre in Chicago. However, not all the interesting facts connected with this wonderful piece of mechanism and the electrician-musician who made it possible were told. In the article which follows the author has added some more details concerning the man and his achievement.—Editorial Note.

The greatest organ builder of modern times is an electrician. He builds wonderful electrical orchestras. This man, who has risen from electrician and church organist in a little English town near Liverpool to one of the most prominent figures in the musical world, is Robert Hope-Jones. Only recently the head of the music department of one of the large Eastern universities, in speak-

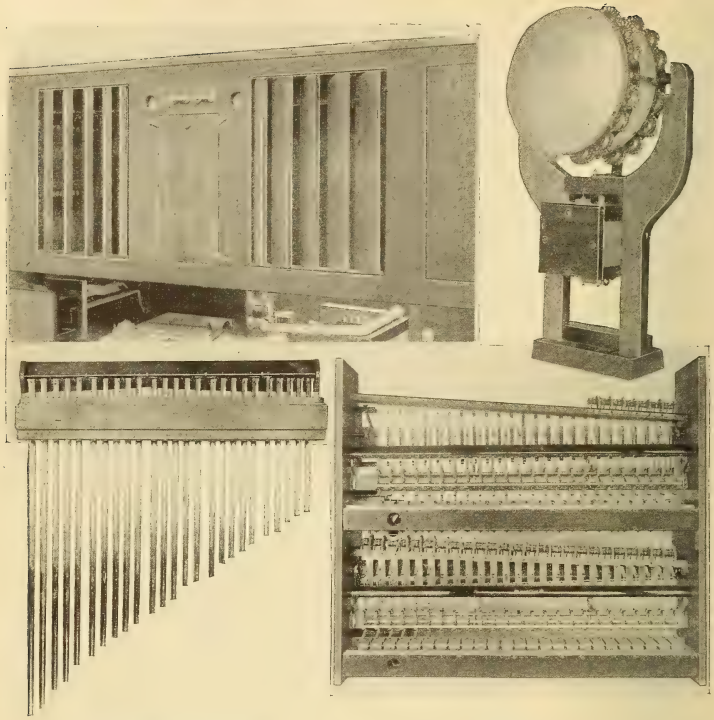
ROBERT HOPE-JONES SPOKEN OF AS "THE GREATEST MIND ENGAGED IN THE ART OF ORGAN BUILDING"

ing to his students, referred to this electrician organ builder as "the greatest mind engaged in the art of organ building in this or in any other age." As the name of Stradivarius recalls rare, wonderful violin tones, mellow with passing centuries, so does the name of Robert Hope-Jones bring to mind a more modern achievement—beautiful music transmitted to thousands through the tones of a majestic orchestra played by a single musician. Years ago, Robert Hope-Jones was chief electrician of the English telephone company and at the same time was organist of St. John's Church in Birkenhead. Then it was that he conceived the idea of playing an organ by electricity. With the aid of his choir members he built such an instrument which, though crude, was the wonder of musicians who came to play it. This gave him the idea of the unit orchestra and in the end led him to give up his position and his country to follow out his work. He combines the typical inventor with the artist. In enthusiasm, ability of conception, concentration and persistency he is the inventor. In his devotion to his art, in expression and personality he is the artist to his finger tips. A true English gentleman, courteous to everyone, modest, chivalrous. It was his country's misfortune when he took his leave and America's decidedly good fortune. To use his own words, which more than anything else—unless it be his early financial failures—illustrate his unmercenary attitude:

"I am thoroughly happy so long as I am building perfect instruments. The profit does not concern me." When he was first sought after to build organs like the first one, finally being prevailed upon to build several, he agreed to do so with only a vague idea of the cost it would involve. "I merely guessed at the cost," he said, "and went to work. It was not until I had lost many thousands of dollars that I discovered my mistake. That is why I came to America a poor man, after selling my British patents to settle my obligations there. I was poor in everything except courage and confidence in myself and my ideas. I brought with me a number of the men who helped build my first organ in St. John's Church, Birkenhead. They are splendid fellows and have stuck by me through thick and thin."

An illustration of what Mr. Hope-Jones meant by this is given us in the building of that celebrated instrument in the Ocean Grove Auditorium. The sum originally subscribed to build it fell short several thousand dollars, and the inventor and his faithful workmen continued their labors almost without compensation. During much of the time he was ill and worked with a fever. The instrument will thus always stand a tribute to the loyalty of these men and the truly heroic perseverance of the builder. Those who have heard the fantasia, "The Storm," played on this remarkable organ need no description of the dignity, beauty and refinement of its tone.

Tone reproduction is one of the things which Hope-Jones has mastered. He is probably the first man who has ever made the study of tone a really scientific one from its practical standpoint. In the realm of tones he duplicates the wonders of Edison in the realm of applied electricity. Imagine, if you can, entering one of the famous old cathedrals on the Continent, in which the organ is noted for one or two particularly rare tones and by means of a little instrument photographing those particular tones. Then to stretch your imagination a bit further, conceive of taking the negatives home with you to America and in your laboratory reproducing that tone identically. That is precisely what Hope-Jones has done and is doing. This instrument is necessarily of his own invention and consists of a lead funnel, in the apex of which is suspended a silvered aluminum mirror. As the sound waves enter the funnel the mirror vibrates and a needle-point ray of electric light is reflected on a screen some ten feet away. The move-



Swell-box Shutter to Give Expression to the Tones. Chimes

Tambourine Chrysoglott

SOME OF THE PARTS OF THE HOPE-JONES UNIT ORCHESTRA

ment of this tiny light spot is recorded by a camera and from the photographic prints the inventor reproduces the tone in his workshop. He says that this scientific tone language is a wonderful thing and its accuracy is absolute. Once you have learned the language it tells you all about sound. He has himself discovered many new tones. One of these he calls the "Kinura" which in the Hebrew means "wailing voice."

Electricity is the basis of operation of the unit orchestra. Tiny electric wires connect the keyboard, or console, as it is called, with the instrument itself. There are thousands of these little electric nerves and they make bundles as thick as a man's wrist. All of the electrical contacts are made of pure silver which has never been known to fail. The voltage used is low, always being less than ten volts. Electricity also drives the fans and compressors which supply the wind for the instrument itself.

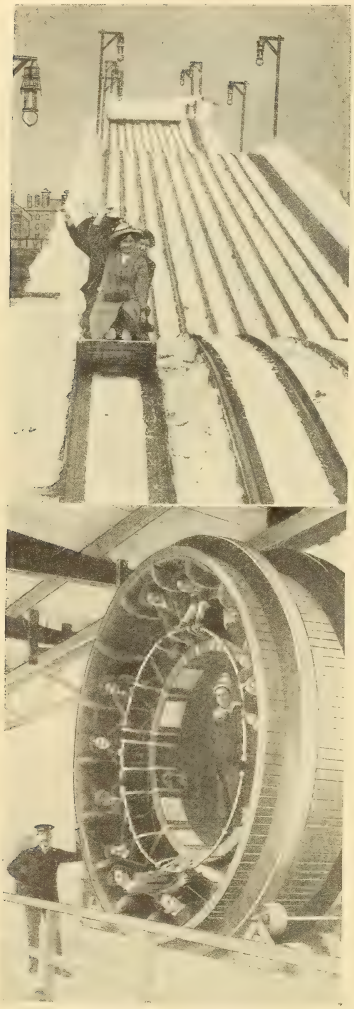
On one keyboard of the unit orchestra are grouped the wood wind stops. On another keyboard all members of the string family are available, on another the

brass instruments, on another the basses and so on. Each one of these families is under expressive control. A touch of the players foot or of one of his fingers, will bring the string group into prominence and will cause the other families to retire until wanted again. Another touch and the strings are subdued, while the plaintive oboe, the clarinet, or another member of the wood wind family makes its voice heard. Instead of one clarinet, able to produce but a single note at a time, there are clarinets capable of playing in full chords at all parts of the compass. The same is true in the case of the brasses, the strings, the flutes, the oboes and all of the others. Thus it can be seen that a musician having control of such great resources can produce effects that are in many points not obtainable from any orchestra, even though it has a hundred performers. It can be swelled up until it rivals the largest church organ in dignity and power and it can be reduced to the merest whisper, as is done in the Chinese music at the "Daughter of Heaven" production. By placing a "vowel cavity," governed by a sliding stopper on each pipe, its tone can be altered at the will of the player so that like the human voice it will sing ah, eh, e, i, o, or u.

The basis of the work is the diaphone, the most powerful foundation stop in the instrument. This resembles the diapason in tone quality, though many distinct colors of tone can be produced from it. It consists of a small aluminum piston which rapidly and freely vibrates in an enclosing cylinder and if supplied with sufficient air pressure can be heard 20 miles away. In fact, one is now used by the Canadian government on the shore of Lake Ontario for signaling purposes and is effective for a distance of 40 miles across water. It is believed that the possibilities of this strange stop have not as yet been fully realized. Strange to say, there are no bellows in the unit orchestra, the wind being supplied by electrically driven fans and compressors, which deliver it at pressures of ten, 25 and 50 inches, meaning the pressure of a column of water ten, 25 or 50 inches high. The highest pressure hitherto used in any organ has been 26 inches, and the pressure on the average church organ is only three inches. By means of the swell shutters, it is thus possible to control the great volume of tone produced by these pressures so that the *tuba mirabilis* of 50 inch pressure can be used to accompany the human voice. The foundation, string, woodwind, brass and percussion departments, are enclosed in their own independent cement swell boxes. All of the stops may be drawn upon any of the manuals or on the pedal at any pitch.

ALL FAMILIES OF TONES ARE UNDER EXPRESSIVE CONTROL FROM THE CONSOLE

The touch, moreover, is as light as that of a grand pianoforte. By exerting a trifle more pressure on any key it sinks an eighth of an inch lower and the stops drawn on another manual then come into play.



Photos by Boston Photo News

THE GLACIER GLIDE AND THE ROLY POLY—LONDON NERVE SHATTERERS

London Nerve Shatterers

Londoners are just as ready to pay money to experience novel sensations as the people in this country who patronize amusement resorts. They love to be bumped and jerked and whirled through space in a manner which would cause them to collapse if they were to undergo a similar experience in an accident. Two of the latest London novelties in this line are known as the Roly Poly and the Glacier Glide.

The Glacier Glide is very similar to our Shoot the Chutes except that a smaller car is used, something like a toboggan which glides down a track over real ice and snow. The car is drawn back by means of an endless cable operated by a motor.

The Roly Poly revolves like a pinwheel and is steadied by two horizontal tracks, one above and one below. It looks like the commutator to a huge electric generator. It is operated by cogs, geared to a track on the inner side. Friction wheels at the base serve to stop or brake it. The passengers climb in at the bottom, and as seats are filled they are whirled to the top of the wheel. When all are in it is revolved along the double rail track by hidden electric motors.

Neon—A New Element With a Future

The surrounding atmosphere contains a number of strange gases which have only recently been discovered and have not as yet been put to any commercial use, but are being investigated and experimented with and there is no doubt that there are future possibilities both in the fields of chemistry and electricity. These gases, among which are helium, argon and neon are known as negative gases, and are most inert and lazy, have no color, odor or taste and will not combine with other elements, chemicals or among themselves. Their names are characteristic, argon being Greek for lazy, neon means new and helium the sun.

Neon constitutes one one-hundred-thousandth part of the bulk of the atmosphere and was discovered by Ramsay and Travers in 1898 in liquid argon. While it resembles both argon and helium its properties are not yet thoroughly known, but its density is ten times as great as that of hydrogen. These gases have the property of glowing with a beautiful, soft, phosphorescent light of various colors when sealed in a glass tube with platinum electrodes, and a strong current sent through.

While they all have this property, neon gives the best results and its light approaches nearest to sunlight and is almost pure white. Experiments so far have shown that a neon tube gives much light in proportion to the current used and after being perfected commercially may be an economical substitute for the incandescent lamp.

The investigators have had two problems to solve before it was possible to even consider the practicability of it as a new form of illumination, apart from the commercial exploitation. The first was the small proportion of the gas as contained in the air and the difficulty of its extraction and purification. This can be overcome by application and perfection of apparatus and process, as the source of supply is unlimited and the proportion never varies under any conditions. The other drawback is also simply a question of experimenting and is in a fair way of being solved.

It was found that the great heat generated by the flow of the current, disintegrated and vaporized the platinum electrodes and deposited it in fine particles on the side of the tube. This deposit of platinum has the peculiar property of absorbing the neon gas, consequently diminishing and finally extinguishing the light entirely. By increasing the size of the platinum electrodes, the current does not heat the electrodes enough to vaporize and the power of the tube is extended. Experts have declared that the future electric lamp will be along these lines.

Electricity in Volcanoes

What a dynamo a volcano in action would make if its power could all be turned to the creation of electricity! This thought is suggested by the observations on Mount Vesuvius which show that strong electro-magnetic currents flow up and down the sides of that mountain, the direction depending upon the condition of activity of the volcano.

When the volcanic forces are at rest, or nearly so, the currents ascend the mountain, but as soon as an eruption approaches they instantly change their direction and flow down its sides to the surrounding valleys. The needles of the galvanometers employed in the study of these currents show the greatest excitement, trembling and leaping this way and that when the lava rises to the throat of the volcano and begins to issue from its vents. At other times the currents are feeble and their effects barely perceptible.

Another indication of the powerful play of electric forces in a volcano is given during great eruptions, when immense clouds of steam rise high above the mountain and stones and ashes are shot hundreds and even thousands of feet into the air. In such cases a brilliant display of lightning occurs in the cloud over the crater although no storm is raging in the surrounding atmosphere.

Man has put a bridle on Niagara and made it work for him in the production of manageable electricity, but it would be too much to expect that he could ever harness Etna, Vesuvius, or Cotopaxi for a similar purpose, even if their power were exercised with sufficient regularity to tempt him to the trial.

For the insect collector the incandescent lamp is suggested as a bait or attraction for nocturnal lepidoptera and other insects. It is proposed to surround the lamps with a globe coated with a sticky composition. The light attracts them and once they touch the globe they are secured

ELECTRIFIED WATER SPRAYS TO ENCOURAGE CROPS

ODD INSTALLATION
FOR ELECTRIC SPRAYING

On Pon Quogue Road, Good Ground, Long Island is a farm upon which are being carried on some unusual experiments with electricity and growing crops. The farm which contains fifteen acres, eight of which are under cultivation, is equipped with a modern electric power plant and pumps. Upon an elevated, insulated platform is a 5,000 gallon metal tank. From the tank run insulated supply pipes over the area cultivated. These pipes at intervals are fitted with spray nozzles. The water in the tank is raised to a voltage or potential of 2,000 and as it sprays out of the nozzles upon the plants these become the medium for discharging electricity from the tank and water to the ground. According to Dr. Emilio Olsson, the owner of the farm, the electrified water stimulates the growth of the plants and also keeps them free from diseases.

By Courtesy of the Bell Telephone News

CABLE SPLICING ON SNOW SHOES

In the Upper Peninsula of Michigan, where this picture was taken, winter is winter with snow and lots of it. Although this cable is upon poles the linemen do not find it necessary to climb them but reach the lines on snow shoes, as is here evidenced.

Running a Farm by the Power of a Brook

By GEORGE F. WORTS

Mr. Henry Ford, of automobile fame, regards his farm as an interesting diversion—a hobby worth while. It is his aim to apply here, through a corps of able assistants, the most modern of agricultural and dairying principles in an effort to create the farm ideal. The farm is situated a few miles out of Detroit on the banks of the picturesque River Rouge which winds in and out among the extensive acres.

TWO VIEWS OF THE LITTLE PLANT ON THE RIVER ROUGE

One day I noticed, stretching along the post tops of a high, woven wire fence, two electric power wires extended inconspicuously, finally disappearing in the distance into a large white barn. From natural curiosity I followed the wires and entered the barn.

TWO ELECTRIC POWER WIRES STRETCHED INCONSPICUOUSLY ON THE WOVEN WIRE FENCE

It was milking time and the last of the blooded Jersey stock had been driven into the clean concrete stalls. Brilliant rows of tungsten lamps along the walls and ceilings threw out a radiance almost equal to daylight. At the correct psychological moment for a group of picturesque milkmaids to appear on the scene, two farm hands approached and commenced to unravel a queer looking paraphernalia which they designated, to our inquiry, as the vacuum milking machine. As the name implies, no milkmaids are required.

The operation of the machine seemed simple; merely necessitating the attachment

of the rubber tubes, the starting of an electric motor which drove the vacuum pump and in a very short space of time the warm white streams bubbled and foamed in continually increasing volume into the waiting pails.

After the milk had cooled it was poured into the electric separator and the cream removed, a portion being retained and sent into an adjoining room where it completed a most interesting series of manipulations by being churned into sweet, fragrant butter for some fortunate "city folks."

The miniature power plant which accomplishes all this work, possesses all of the elements of a large commercial installation, but on a very small scale.

The water falls a distance hardly greater than a man's height; yet sufficient energy is developed to spin the little generators and carry with ease their load of numerous large motors and hundreds of electric lamps, "taking the undesirable work out of farming and the darkness out of night," in the words of one of the supervisors.

The farm is under the joint supervision of two young men, typical examples of the modern school in which no place is allowed for old fashioned methods or principles. As to the success of their specific experience in the application of electricity to modern farming practice they spoke glowingly and, further, voiced their intention of extending the uses of the electric current to the very limit of their scope—even into the fields—an innovation not yet attempted, to any extent, in this country.

The machine shops, containing the lathes, drills and presses; the dairy plant, including the milking, the cream separating and the churning; the elevators, grain, corn and fodder—all depend upon the electric current for their source of motive power.

The spacious dwellings, the immense dairy barns, the sanitary stables and the numerous small sheds are aglow every night with the radiance of an abundance of brilliant tungstens. Electric heating is one of the latest institutions.

And from a secluded bend of the hurrying little river comes the unmistakable, penetrating hum of an electric generator —the factor which has made the venture a practical success.

"Cold Light"

When the current of a Rühmkorff induction coil is passed through a glass tube in a vacuum the tube glows with a brilliant light. Certain authorities hold that this is the light of the future. Hitherto it has not been found possible to produce light without producing heat; but, in the view of experts, this difficulty has perhaps been met by the invention of the improved Geissler tube. The light of the future, we are told, will glow through long transparent tubes of all sizes and calibers, able to take the most varied directions and to run horizontally, vertically or obliquely, forming stars, rosettes, spirals, arabesques, etc.

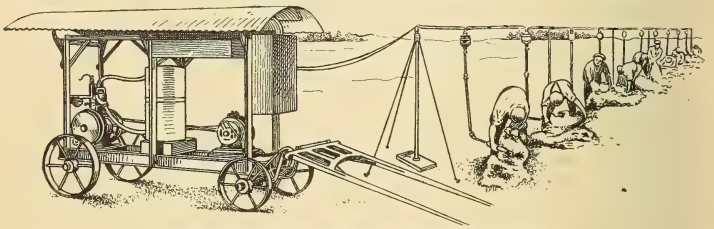
The tubes are said to radiate a diffused glow from end to end, the effect being that of intense lunar light. This, it is added, is the colorless light demanded by painters for their studios, for museums, to say nothing of homes. By charging the tubes with different gases various colors can, it is alleged, be obtained. Nitrogen gives a warm golden glow.

College Men in the Central Station Business

It was recently stated by Mr. Holton H. Scott, second vice president of the National Electric Light Association, that up to June, 1912, there were about 30,000 graduates of electrical courses in all the leading universities and colleges of the country. Of that number there were not to exceed 3,000 in the electric central station business. So there seems to be some foundation to the complaint which has been made that the central stations are not getting their share of the technically educated men.

Sheep Shearing in England

In England use is made of a portable electric sheep shearing outfit of a type shown in the drawing. A small gasoline engine mounted on a light truck drives a dynamo which sends current out over the improvised transmission line. At regular intervals motors are operated from



SHEEP SHEARING BY ELECTRIC MOTOR DRIVEN CLIPPERS

this line, each motor driving a flexible shaft carrying on the end a set of clippers or shears. A very high speed must be maintained by these motors—2,800 and 3,000 revolutions a minute—in order to give sufficient vibratory speed to the shear blades to enable them to cut through a heavy fleece.

The same machine can be used for horse clipping also. In that case a speed of only 2,000 revolutions a minute is required. The English company which makes the machine has, therefore, devised a two speed motor which is available not only for its regular work but for other power purposes about the farm.

Two Great Scenic Railways of Mexico

The Mexico Tramways Company, Limited, is at present actively engaged in the installation of two very costly and important interurban railway lines. The line to Toluca, capital of the State of Mexico, will be 41 miles in length, measured from the principal park in Mexico City. This road will pass over mountains and into valleys which will make it one of the most beautiful and scenic roads on earth. When the road will have been completed one can step into one of the elegant cars at the principal park in Mexico City and be in the city of Toluca one hour and 50 minutes later, a distance which now requires very nearly four hours by steam locomotion owing to the excessive grades.

The City of Mexico will be visible until the summit of "Las Cruces" is reached, affording one of the most beautiful panoramic views, that of the Valley of Mexico, to be seen anywhere in the world, lasting for at least 20 miles from Mexico City. From here the down trip will commence and again scenic beauties will be open to the gaze of the passenger.

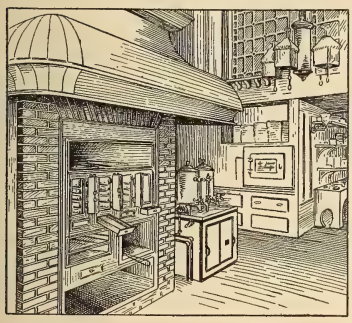
This road will pass through the towns of Santa Fe, Cuajimalpa, Acapilco and Lerma. The highest point reached will be at the summit of "Las Cruces" when the passenger will be 10,200 feet above sea level. The electric line will reach a point about 330 feet higher than the Salazar summit—the present highest railway summit in Mexico, of the National Lines between Mexico City and Toluca.

Besides being the highest standard gauge electrical railway in the world, the line between Mexico City and Puebla (another still more important interurban electric line under construction) will rival the famous scenic railways of Switzerland and other parts of Europe. The trains will leave the principal park in Mexico City and pass

through the town of Xochimilco and from there on between the two snow capped volcanos of Popocatepetl and Ixtaccihuatl. The highest point of this line will be 12,500 feet above the level of the sea. Here the traveler will get a breath of the pines, be impressed by the majesty of the near-by volcanoes and feel the crispness of the air caused by the perpetual snows of these celebrated peaks. This road will be 111 miles long.

Electric Broiling in the Engineers' Club

One of the show features of the Engineer's Club in New York is a six oven electric grill for broiling steaks, chops, etc., and its successful operation shows what may be done in the way of electric



ELECTRIC GRILL IN THE ENGINEERS' CLUB

cooking. The club serves many members and guests, and broil orders coming to the chef in rapid succession are executed quickly with perfect control of the cooking temperature. The ovens have three heats, from a dull red to white hot, controlled by an outside adjustable resistance. During the busy hours at meal times the ovens are kept permanently on the lowest heat so as to be warmed up and ready.

Suppose the order is for a nice, thick steak. The chef turns the controller of one of the ovens to the high notch, which brings the walls of the oven instantly to full incandescence. He then picks out the sirloin or other cut desired, slips it into a double wire holder and inserts it between the two glowing walls where it is exposed on both sides to the strong, even and perfectly controlled heat of the resistance units. The intense heat promptly seals the surface of the meat, preventing undue escape of the juices and the cooking is completed in the remarkably short average time of thirteen minutes. Any gravy which drips down falls into a small trough of water at the bottom of the oven and can not catch fire as it would be liable to do if exposed to an open flame of any kind or to glowing embers of coal or charcoal.

The electrical energy is supplied from an isolated plant on the premises at a very low operating cost. But in this installation the cost of operating does not figure. It is the time saving and the quality of the broiling that makes this club grill a success, there being less diminution of weight than in ordinary broiling and complete freedom from the smoke and ashes which are met with in the use of charcoal, coal or gas.

Of Interest to Elks

Electricity has found a place in memorial services. Once every year the Benevolent and Protective Order of Elk, known the country over as the Elks, holds what the order terms a Lodge of Sorrow. Services are held in honor of the dead and speakers are called upon to eulogize the members who have died during the year. At Seattle recently, during a session of the Lodge of Sorrow, electricity was used in flashing the names of the departed members in big, bright letters as they were called off from the roll of the dead. This arrangement was so impressive that it will be carried out in future years, and no doubt other Elk lodges throughout the country will not be long in adopting this effective and dignified addition to the ceremony.

A Future for the Farm Engineer

By FRANK KOESTER

Up to the present time, especially in America, the aid of the technical man is little sought in solving many of the problems which arise in rural industries. Probably there is no better authoritative statement on the value of technically trained men as an aid in modern farming than that made by Col. Roosevelt on August 23, 1910, at Ithaca, N. Y.

PORTABLE ELECTRIC GENERATING PLANT AS USED FOR PLOWING IN GERMANY

"One reason why the great business men of to-day have gone ahead while the farmer has tended to lag behind is that they are far more willing and eager to profit by expert and technical knowledge. No great industrial concern can nowadays be carried on save by the aid of a swarm of men who have received a technical education in chemistry, in engineering, in electricity or in other subjects. The big business man or the big railway man, does not ask college trained experts to tell him how to run his business, but he does ask numbers of them to give him expert advice and aid on some one point indispensable to his business.

"In just the same way the farmers should benefit by the advice of technical men who have been trained in phases of the very work the farmer does. While there should undoubtedly be such a training as a foundation (the extent differing according to the kind of work each boy intends to do as a man), it is nevertheless true that our educational system should more and more be turned in the direction of educating men toward, and not away from the farm."

An up-to-date farmer should possess his own electric generating station which may be operated by water, steam, gas or engine power. In many instances where a stream runs through the property or neighborhood, cheap power may be derived from this natural source as regards the first cost and operating expenses.

The main feature in which the great advantage of an electric farm lies is that the farmer himself has at all times under his direct control the entire supply of electric energy being used, which may be obtained from some public service corporation at from five to ten cents per kilowatt hour, or better still, the energy may be supplied from his own private generating plant at cost varying from one cent per kilowatt hour and upward.

A policy much adopted abroad is to install a rural central station for the purpose of supplying a number of farms, rural industries, country residences and estates with electric current. By establishing a rural central station, a great saving in the production of electric energy may be secured. To-day we find in Germany as many as 100 to 150 consumers being supplied with electric energy from one of the numerous rural central stations.

Another very decided feature is that a few motors properly selected can operate all of the machines on the farm. It is just in this feature that there lies a great advantage in electrically operated farm machinery. Take, for instance, a motor placed on a low four wheeled truck and brought to the threshing machine and connected by means of a belt. The motor is connected to the electric supply mains by a flexible cable plugged into a suitable outlet. After the threshing is completed, the motor may be connected to the baling machine which packs the straw into bales and if necessary the motor can be used in loading the bales onto wagons by operating a hoist. At other times the same motor drives the water pump, wood saw, etc.

Electric plowing has been carried on in Germany for some fifteen years and in the last few years great strides have been made. Of the several systems employed, the one and two motor systems are most extensively used. Both methods attain the same result; that is, a plow is pulled across the field by a cable wound on a drum.

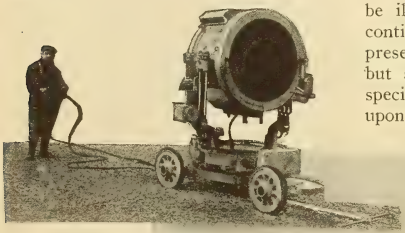
HAY CUTTER OPERATED BY A PORTABLE MOTOR

In the single motor system, on one side of the field is a motor mounted on a self propelling wagon, while on the other side is an anchor wagon which automatically travels forward parallel with the motor wagon with each new furrow. The two motor system has two motors on self propelling wagons, one replacing the above mentioned anchor wagon. The former system is lower in first cost but the latter has greater flexibility—it can readily cultivate any form of field.

Electric plowing has great advantages over gasoline or the steam engine plow system; for instance, in the latter case a great amount of coal and water must be brought to the field. The electric plow too can operate in soft or loamy soil where horses cannot work and also in hilly ground.

As far as the cost of electric plowing is concerned, experience shows that it can be done cheaply. The field of electric plowing to-day is found principally in Germany; it is an established fact however that American agricultural machinery, in its wide practical application, in most respects is far superior to that of any foreign make and should domestic

manufacturers devote themselves to electric plow machinery it would be a question of only a short time when our farmers would recognize the advantages of the system. The practical application of electric plowing is not confined to farms of large acreage; it can be carried on to good advantage on farms of small size.



An article on electricity on the farm would be incomplete without mentioning lighting. The need for an efficient lighting system is well recognized as one of as much importance for the country as for the city. It will assist in fixing hours of labor as they are in the city, which is necessary to satisfy the just demands of farm hands as well as others abiding in the country. Due to better light, great efficiency and cleanliness are secured all around, fire risks are diminished and insurance rates are reduced. Electric lamps require no matches, burn without flame, consume no oxygen and therefore do not vitiate the air of the room. Electric lighting is particularly serviceable for stables and barn, where the use of lanterns has caused numerous fires.

Another great advantage in using electric illumination is that like the street, the yard and field may be lighted and controlled from the residence. This feature is especially convenient when in the fall of year harvesting is necessarily carried on after dusk in order to ward off any chances due to weather conditions. In such cases, the field under harvest can be illuminated to advantage and work continued long after night fall. To the present day farmer this may seem absurd but such things will come with highly specialized farming which must soon be upon us.

FRENCH AUTOMOBILE SEARCHLIGHT THAT CAN BE REMOVED AND OPERATED AT A DISTANCE FROM THE CAR

French Automobile Searchlight

The French war department has lately put in use an improved type of automobile searchlight for use in field operations, especially to detect an enemy's movements at night. What is to be noted about the new apparatus is that a single automobile carries the whole outfit. The gasoline motor serves not only to propel the autmobile but also operates a dynamo for the searchlight, and even when on the road the searchlight can throw its power-

ful beam of 7,000 candlepower in any direction. As the whole searchlight is mounted on a four wheeled carriage it can be taken off and run for as much as 300 feet from the automobile.

The officer is always stationed on the automobile and directs the projector by the use of a distant control method such as is now used in order to avoid standing beside the searchlight as this gives a blinding glare and prevents good working. An electric cable unrolls from a drum on the automobile for carrying the current.

Effective Indoor Sign

The accompanying picture shows an effective indoor electric sign located at

EFFECTIVE INDOOR SIGN

the entrance to the application department of the Commonwealth Edison Company's offices, Chicago.

The sign is formed of miniature lamp letters, each letter being a tube of glass, within which at intervals are tiny carbon filaments supported upon platinum wire in the back. With the current on, these filaments or "beads" as they are called, form a perfect, glowing and effective sign letter for indoor use.

The Great Arlington Towers

This striking photograph was taken looking up from the bottom of the highest of the three enormous wireless towers

Photo by Paul Thompson

LOOKING UP ONE OF THE ARLINGTON TOWERS

at Arlington, Va., which the Navy Department has just built. This tower is a little over 600 feet high. The operators have been tuning up the station since the plant was completed and have been gradually extending their zone of communication until at last they have exchanged messages with the Mare Island station near San Francisco. These points are 2,117 miles apart. A message was received recently from the steamship Tennessee on her way to the Straits of the Bosporus when she reported as being 1000 miles out of New York.

It is expected that these towers will form a point of interest for tourists and that a great many visitors to Washington will go there to see them. They have stairways up to the tops and people will perhaps be allowed to ascend.

How Rubber Came Into the Electrical Industries

That rubber has been an important factor in the development of all sorts of electrical apparatus and in our ability to utilize electricity so variedly, is too well known to need further comment. But that rubber covered wires are almost as old as American rubber boots and that a threatened jail sentence speeded the developing of rubber coatings for wires—that will be new to most readers. And thereby hangs a tale.

Going back a full 300 years, we find that the Mexican tree which yields the highly prized rubber sap was already known to Europeans. At that time Juan de Torquemada—a Spaniard noted alike for his gifts to charity and for his theological writings—mentioned this remarkable tree in his writings, adding that the sap was made into shoes or used for waxing canvas cloaks to make them resist water. A century and a half later the English began to use what they called "elastic gum" for erasing pencil marks. But it was not until about 1820 that the Scotch chemist, Macintosh, developed the process of waterproofing fabrics which has made his name famous the world over, and not until about five years later that rubber shoes were first sold in this country. By 1840, something like a million pairs of rubber shoes and boots had been imported into the United States. Efforts to produce them here had been a failure until in 1838, Charles Goodyear—then a bankrupt hardware merchant—invented the process of "vulcanizing" rubber by heating it with sulphur.

Meanwhile, British travelers had been bringing samples of rubber sap from the Malays and one of them who had greater business foresight than the others had brought with him several hundred pounds. This soon attracted the attention of Carl Siemens, then just of age, who had been sent to England to exploit his brother's inventions. The elder Siemens (Ernest Werner) was extremely anxious to educate his sister, but sadly handicapped by his meager salary as an artillery officer. Being of a scientific turn of mind, he had already made a number of inventions, including a silver plating process for which his brother promptly sold the British rights. Werner had also made improvements in the methods of using gun cotton and while his advances in this line were not so noteworthy as to be historic, they still secured for him the official clemency which afterwards meant so much for electrical progress.

Alert of mind as might be expected in a scientist, he also was not bound by conventionalities in his thoughts along other lines. Consequently, when some officially tabooed free thinker gave a lecture at a near-by point, Siemens was one of the officers who incurred the displeasure of the authorities by openly attending it. The offense was too serious for mere censure and jail sentences were dealt out to all except Werner Siemens. In his case, the sentence called for confinement at the fireworks laboratory at Spandau, where it was thought that his experimenting might lead to further developments of value to the German army. There he was delighted to receive a sample of the gutta-percha which Montgomerie had brought to London and which the younger Siemens sent on as an industrial curiosity.

On testing the new material, Werner Siemens readily found that while it became plastic when heated, it hardened upon cooling and formed a good insulator—a fact which delighted him all the more when he found that he could coat a wire with this strange material. But the coating had a way of peeling off again which was rather distressing, so Siemens interested an able mechanic in the same. It was G. J. Halske, who soon planned a press for forcing the rubber covering upon the wire and thus making a more durable insulation. That was in 1847 and during the following year the newly formed firm of Siemens and

Halske had occasion to demonstrate the value of the rubber covered wire by using it in connection with the first submarine mines. So, also, Siemens was commissioned by the Prussian war department to run some of his rubber covered wires underground, but the suggested use of an iron pipe or of a wrapping of iron wire as a mechanical protection for the rubber was vetoed as being too costly.

However, Siemens had not been alone in finding ways of utilizing gutta percha. Others had done the same and the price of the raw material jumped up at a rate that might have permanently stopped its use had not Goodyear's invention of vulcanizing enabled manufacturers to obtain an equally high insulation with a much smaller quantity of the gutta percha. Incidentally, Siemens had learnt that his rubber wire coverings had occasional faulty spots, which he located in a crude but undoubtedly effective manner by passing the wire slowly through a vessel of water into which a workman dipped one finger. One end of the wire and the man's other hand were connected to a source of current and whenever a poorly insulated spot was reached, the human leakage detector jumped.

Thus the use of rubber covered wires was developed 30 years before rubber was used either for wheel tires or for gossamers, and 20 years before the Civil War created the demand which led to the making of rubber blankets and heavy rubber coats. But rubber insulations might have been delayed many years longer had not Siemens' independence of thought earned for him both the threatened jail sentence and its commutation to laboratory service.

RAILLESS ELECTRIC TRACTION IN DUNDEE

Dundee, situated on the river Tay, is the third city in Scotland, has a population of 170,000 inhabitants and is the center of the British jute industry.

The general layout of the city is most suitable for a successful trackless trolley

RAILLESS TROLLEY IN DUNDEE

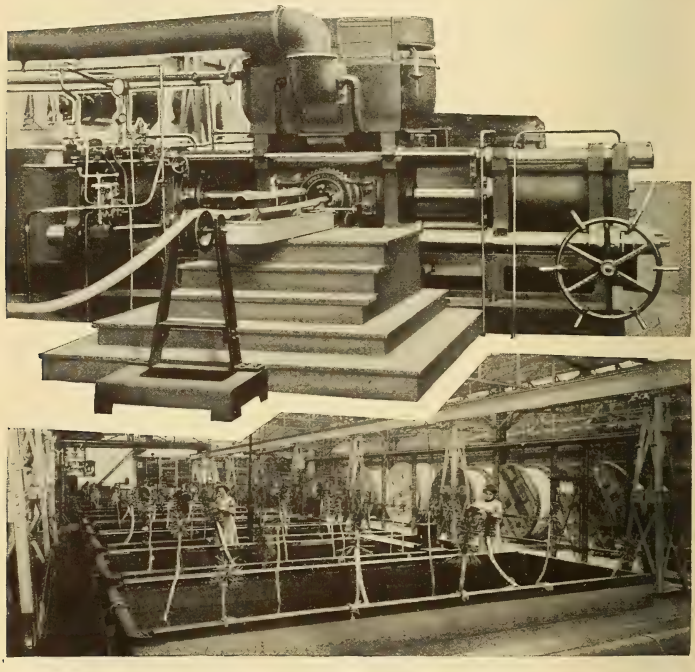
car service, as nearly all the main streets converge to High Street, which is in the center of the city and is a starting point for all cars. "A penny (2.03 cents) all the way" is the fare, which means to the end of the line. Half-penny stages are also arranged, the longest ride being 3½ miles.

The cars are owned by the town council and current is supplied by the electric lighting department, which is responsible for the erection and maintenance of the overhead equipment. This is carried out on the span wire system, negative and positive trolley wires running the whole length of the route, with extended curves at each end for turning the cars.

Poles are spaced about 100 feet apart and erected on the edge of the pavement to prevent obstructing the roadway and at the same time to allow as much room as possible for the cars when passing other traffic. As the average width of the road is 27 feet, two cars traveling in opposite directions can simultaneously pass a vehicle or an obstruction.

Putting the Lead Sheaths on Cables

Few people living in cities where telephone lines are placed underground have not seen the great reels of lead-sheathed cable standing at the mouths of the manholes. Many have no doubt wondered how the seamless sheaths are put over the bundle of wires within, for it is obvious the latter could not be drawn through.



THE UPPER VIEW SHOWS THE HYDRAULIC PRESS WHICH PUTS THE LEAD CASINGS ON CABLES. BELOW IS A CABLE TESTING ROOM

In explanation it may be said that the lead cover is put on the cable by means of hydraulic pressure, the wires of the cable (there may be a hundred or more pairs of them, each individual wire wrapped in a paper cover) are twisted together into a cable an inch or more in diameter. It is then passed through the hydraulic machine shown in one of the illustrations. The lead for the cover is heated to a plastic stage and forced under a pressure of 2,080 pounds to the square inch through a matrix. A hollow plug gauge corresponding to the section of the cable is projected into the matrix and the cable made to slowly traverse the gauge. At the same time the lead which is forced through the annular space between the matrix and the gauge comes out along with the cable as a round, seamless cover or jacket. The machine shown

is one in the Oberspree Cable Works near Berlin, Germany.

Any number of wires up to 800 pairs can be twisted and covered with a jacket in this manner. When the cables are completed the wires must be tested out to find if there are any broken ones, crosses, grounds with the lead cover, etc. In the above works this is done by women, as shown in the second illustration. The cables are immersed in tanks of water for 24 hours, in order to ascertain if they are water tight. The ends are then bent upward and the wires all "fanned out" until they look like miniature palm trees. This enables the women to make the electrical contacts with each individual wire and proceed with the tests.

Electrocution of Superfluous Animals

The Animal Rescue League of Boston, Mass., was organized many years ago to provide homes for stray cats, dogs and other animals and to humanely end the lives of such animals as are found to be diseased or for whom a good home cannot be found. During 1911 over 23,000 cats and kittens, 5,454 dogs, 175 horses and numerous birds, rabbits and squirrels passed through its hands. As many of these must be exterminated, an electrocution outfit was developed for this purpose that has been found completely successful, both from the humanitarian and economic standpoints. It is operated by one man, who can destroy 200 cats or 100 dogs in an hour, while two men can destroy 300 animals in an hour.

In the bottom of each dog cage is a metal pan forming one electrode; a metal collar placed about the animal's neck forms the other. On closing the door the primary circuit is suddenly closed and the animal is instantaneously rendered unconscious. The cat cage is somewhat different, in that no collar is used and in place thereof two electrode bars are in the bottom, on one of which the cat's fore feet are placed and on the other the hind feet. Closing of the cover closes the transformer primary and the high-voltage secondary current immediately passes through the animal's body.

"Readiness to Serve"

An epigrammatic and philosophical paper with the above title was read before the recent convention in Boston of the New England Section of the National Electric Light Association by Mr. Levin J. Chase, manager of the Concord, N. H., Electric Company. An excellent passage is as follows:

"One of the stereotyped expressions of the lighting business is 'Readiness to Serve,' and that phrase taken in its broadest sense is to my mind the vital principle of public service. In order to broaden its sense, I will amend it slightly and let it stand 'Readiness to Serve Faithfully and Graciously.' Some service has all the essential characters of assault and battery. There is no moral quality in service, either personal or public, unless it is performed graciously and with a wholesome faith in humanity. Moreover, it is my settled conviction that no man is qualified to direct the public policy of a corporation unless he believes in human nature and in the general worth and integrity of the people he serves."

Tungsten Electric Furnace

Two German scientists, Fischer and Nede, have made an electric furnace in which the heating part is of tungsten and it appears to be very good for melting small quantities of metals. Current comes to the electrodes made of a thick copper tube closed at one end and cooled by a water circulation inside them. The two tubes are mounted with the ends facing each other and in the space between is placed a glass globe with double opening. Over the glass there is a constant water flow to keep it below the melting point.

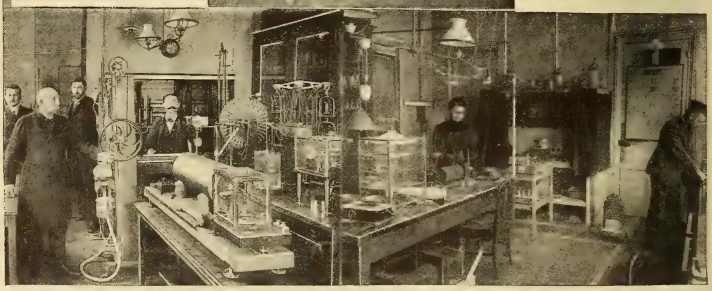
Between the ends of the copper pieces lies the tungsten heater and this is made of a tungsten tube prepared by compressing the powdered metal.

Wonderful Laboratories of the Sorbonne

SOME VIEWS IN THE FAMOUS LABORATORIES OF THE SORBONNE, PARIS, UNIVERSITY· HERE MADAM CURIE MADE HER REMARKABLE DISCOVERIES IN CONNECTION WITH RADIUM AND NOTED SCIENTISTS LIKE HENRI AND LIPPERMAN CARRY ON THEIR WORK

Almost everyone has heard of the Sorbonne the famous college of physics of the Paris University. It was in the laboratories of the Sorbonne that Madam Curie worked in connection with her discoveries concerning radium, and many other great scientific achievements have originated there. It is of interest therefore to present here a few pictures of the interior of this wonderful laboratory or rather set of laboratories many of which are devoted to electrical work of various kinds. Here are carried on experiments which often lead to very valuable results not only for science but also for the practical world.

A striking instance is the work of Prof. Henri upon the effect of ultra-violet light upon microbes, which had its beginning in experiments in this laboratory and the result is now being applied for water purifying apparatus, even for large city supplies. In another of the laboratories, Mr. Lipschitz is working on a compressed air phonograph which imitates the human voice by means of air passing through photographically produced holes in a rapidly moving strip. Prof. Lippmann also has his laboratory in the buildings, and is engaged in electrical work at present.



The photographs reproduced show all manner of electrical apparatus—great induction coils, static machines, light measuring devices and delicate apparatus used in electro-chemical experiments—and we wonder what world astonishing discovery will next be announced from the Sorbonne.

Telegraph Crossarms After 43 Years

Relics of the early days in telegraph line construction in the form of crossarms that have withstood 43 years of hard service amid sleet and sandstorms in rough Western country may be seen in the Chicago offices of the American Crossarm Company.

The crossarms were taken from a line of the Western Union Telegraph Company between Cobre, Nev., and the Utah state line and have been in actual

A CROSSARM RELIC OF THE EARLY DAYS

service since 1869. The illustration shows the old time lightning arrester consisting of No. 13 gauge wire wound a few turns around the arm. This was connected to a ground wire running down the pole. The outside of the crossarms is full of grooves worn by sandstorms the softer portion wearing away more rapidly. Within, the wood is dry and hard, showing positively no sign of rot or decay, and the arms are sound and strong enough for another half century of use. The arms are of Washington fir or yellow fir or, as it is sometimes called, Rainier fir. These trees, like the one shown, are giants of the forest and grow on the Cascade Mountains in Washington. Some of the trees run from fourteen to sixteen feet in diameter and 400 feet in height, 200 to 250 feet without a branch. The fine grained cross section shows a Rainier fir wood while the other section, a piece of red fir, is taken from a small or second growth tree, and explains by its coarse rapid growth why it is poor crossarm timber.

And Then the Turks Began to Fight

On the very eve of the outbreak of the present war in Turkey a letter was written to POPULAR ELECTRICITY MAGAZINE by one of its subscribers—Theophil George whose address is Vill Yacoruda-Ragby, Salonica, Turkey. In view of the great upheaval there, certain parts of this letter will be interesting, and we quote them in his own wording.

"The letter I am writing it now has to go on horseback through very bad roads for four days or 120 miles, that is the railroads in turkey is far from us, and the other roads are in bad condition.

"The navy is good for nothing just at the moment when, must defend the country in the war with Italy she is around Constantinople or in Marmor Sea.

"The rule is also bad enough if it was a good one no revolutions would exist as it is now the anarchy is allover the country, the explossions of hell machines and bombs is very often followed by numberless victimes only at the explossion of a hell machine at city of Kochany which is said to be brought by Bulgarien Revolution organization, were killed about 12

men from the bomb after that the turkish people get mad and started to kill every one they meet with Bulgarien's name as a result from that in the next morning in the church's yard were lying about 140 bodies—and many more.

"Then how should you call such a country? civilized(!!?) where a man is worth no more than a fly.

"The anarchy in the empire forced the government to instal telephones in every village and 'corp dee gard.' Let me give you the conversation of two turks about the telephone.

"The first, Mehmed—'Say Xidar do they made a talifone in your village?'

"Xidar—'What is that hell talifone? I don't know anything about it.'

"The first, Mehmed,—'That is something like horn—inserted in a empty box, and this box conected with another one with iron thread, if you talk to one of them boxes some one can hear you at the other box.'

" 'Once the children of our major of the village, Murtaza aga, ordered by the talifone for some vegetables at their father which was at the town that time, for a great surprise, next evening, Murtaza aga came with the vegetables.'

"Xidar—'How is such a thing possible to talk here and be heard such a long distance as you say, that is impossible for a man to do it except Allah (God) and it such a thing is made it is from Kiafirs (Non Musulman)—they know such deivilish things as that, and it a great sin for a musulman to use it.'

"Mehmed—'That is right, Xidar, that is deivilish work and Allah (God) will not allow to a musulman (right believer) to use it.'

"Xidar—'Do you see now that it is a trick?'

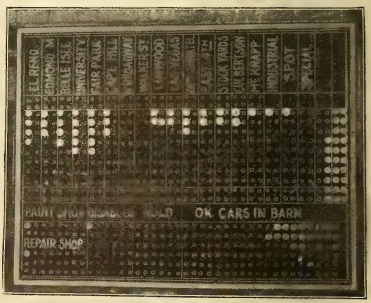
"Mehmed—'Ya-a trick, deivilish trick.'

"That is the way they think about Mr. Graham Bell's invention and the alytric, [electricity] as they call it.

"Anarchy is in its highest point and the murder is a plessure in Turkey. Bulgarie—aided by france Russia and some other countries gave a note to Turkey, either to give Autonomy of Macedonia or with Christian General Governeur or to fight, Turkey refused the note and now from 15 to 70 old is on foot, great preparations are made at the frontiers. The roads being in bad condition everything, food, explossives has to be carried on horse back about 120 miles to reach where we are our village is about ten miles far from the frontier the people is very much afraid because the war is to begain to night or in the morning (if fight is to be) and if yet a life I will let you know, what I am doing and how I become interested in POPULAR ELECTRICITY MAGAZINE."

Car Location Board

For keeping an accurate record of the location and condition of all cars at the shops of the Oklahoma Railway Company, Oklahoma City, Okla., a car location board, as it is called, is used.



CAR LOCATION BOARD

This board is laid off in sections to represent the different lines and divisions on which the cars operate; also to represent cars in the paint shop, repair shop, disabled cars, and O. K. cars in the barn. There is a plug for each car, the number of the car in question being printed on the head of the plug. As the cars are moved from one division to another or from one location to another the plugs on the board are changed.

Felling Trees With Electric Saw

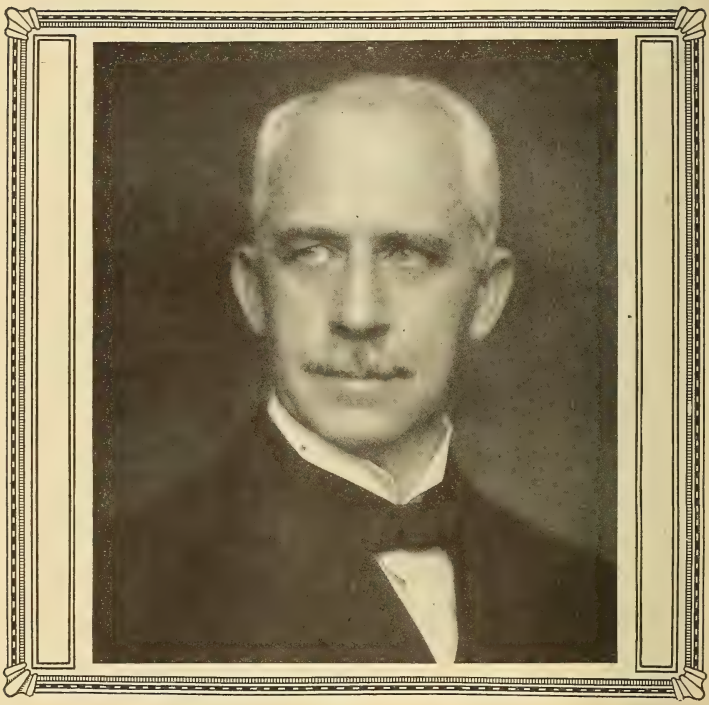
The sharp, steady sound of the woodcutter's ax and the swish, swish of the two handed saw in the forest are giving way to the hum of the electric motor and the buzz of the circular saw which it drives.

The Crescent felling saw is geared to an electric motor, the whole resting upon a track which is in the form of a half circle. By setting the open side of the track about the tree to be felled, the operator can guide the saw so that trees up to four feet in diameter can be cut down.

Where electric power lines are not within reach, several of these saws are operated from a gasoline driven generator mounted upon a truck, current being delivered to each motor through a cable laid upon the ground between the generator and saw.

Electrical Men of the Times

GENERAL GEORGE H. HARRIES



There is something about the keen, steady eyes of this man that suggests to one those "nerves of steel" with which the hero of a novel is so often endowed. Back of them lies that singleness of purpose which enables a man to bring the bead of a rifle sight squarely on the mark and pull the trigger at the right instant. It is not surprising, then, to learn that the subject of this sketch has won a national reputation as a marksman with both rifle and pistol. Neither is it surprising to find that this same calm, cool precision which has scored so many hits in pastime sport he carries into the administration of the numerous undertakings that have been placed under his supervision.

A survey of the career of General George H. Harries clearly indicates a very human side to his nature, for his many achievements in the electrical and other fields have been remarkably free from the accompaniment of envy on the part of those in any way associated with him. Early in life he realized that a man could not succeed without the confidence

and help of his fellow men and this he freely admits. It has proven to be largely responsible for his success which has been crowned, so to speak, by his election to the highest office within the gift of the American Railway Association, representing 365 companies whose tracks form a veritable network of trolley lines over this country and whose membership, numbering 2,550, comes from operating, executive and, in fact, from every department in the electric railway traction field.

General Harries was born in Haverfordwest, Wales, in 1860, came to this country with his family at the age of sixteen and settled near the present location of Winnipeg, Manitoba.

As an army scout on the frontier in the '80s he proved his mettle as a man, for Indian campaigns in the old fighting days demanded the bravest and best. His knowledge of the red man, gained from this source, enabled him while a member of the Sioux Commission (appointed to settle many Indian difficulties) to arrange important matters amicably and satisfactorily to both sides, thereby making for himself many friends among the various tribes in conflict.

There are two cases of Indian curios at the National Museum loaned by General Harries and every piece represents an adventure—some pathetic, many dangerous and each interesting.

In 1897 President McKinley made him a brigadier general, a commission that carried with it the command of the National Guard of the District of Columbia and the defense of the City of Washington. During the war with Cuba General Harries was in command of a regiment of infantry. Service at the Capital and his ability carried with it a wide acquaintance with men in public life.

Twenty years ago traffic conditions in the City of Washington were in what seemed to many to be a hopeless condition. General Harries made a study of the situation and presented his views to the public through the *National Republican*. He was immediately taken from the editorial desk and made consulting engineer of the old Metropolitan Railroad. Step by step he progressed, finally being largely responsible for the formation of the Washington Railway and Electric Company which controls the traction and lighting interests of the Capital. For over twelve years he was vice president and general manager, resigning in 1911 to assume a place in the growing interests of H. M. Byllesby & Company, of Chicago. He has just been elected a vice president and also has direct charge of the Byllesby interests centering in Louisville, Ky.

At the farewell dinner given General Harries on the eve of his departure from Washington, unusual tributes from all classes were paid him.

"Some men attract our hearts," said Thomas C. Noyes, the newspaper publisher, speaking at this dinner, "some attract our intellects and some attract both our appreciation and our intellect, and such a man is George Harries."

"He was in the trenches before Santiago," said a well known army officer, "and few know of it from his lips. No beating of tom-toms is necessary to tell the story of his record in the war with Spain."

"For years he served this city loyally and faithfully and has done a service not only to the District of Columbia, but to the whole country, which merits this expression of gratitude," said a former commissioner of the District of Columbia.

In response to all these laudatory speeches General Harries modestly replied, "I am only conscious that I have kept the faith."

Personally General Harries possesses that happy combination in his character that wins success yet makes and retains friendships. He is a clean fighter and never knows defeat. He illustrates his points with stories that are fit. He knows how to draw the fire of the opposition and when not to fire, himself. Men-

tally alert, physically vigorous, knowing exactly what he wants to do and how he wants it done, he is a distinctive force in the public utility field.

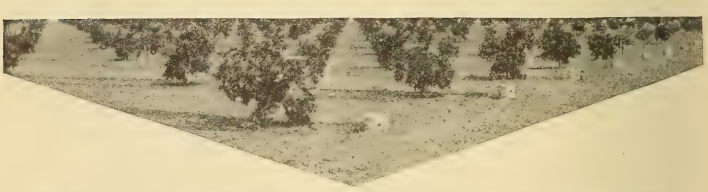
He has just retired as president of the Association of Edison Illuminating Companies and is a member of the public policy committee of the National Electric Light Association, having also served this body as its treasurer.

He is an associate member of the American Institute of Electrical Engineers, a member of the Illuminating Engineering Society, the Washington Society of Engineers and the Washington Academy of Science.

In Louisville General Harries has been both a delight and the source of many surprises. The purchase of the Louisville Gas Company, the Fetter plant, the Campbell plant, the consolidation of these and the great impetus given the company's business is directly traceable to his inspiring presidency of the gas and lighting companies. He is beloved by his managers and employees for what he is—hence the spirit of co-operation. To the public he has repeatedly said, "You are a partner in our enterprise; we want you to exercise partnership rights so as to serve the best interests of the people. We will work together for the mutual welfare of everyone."

General Harries makes his home in Louisville with his son but spends a part of his time in Chicago and Minneapolis; he is vice president of the Minneapolis General Electric Company.

ELECTRICITY TO SETTLE CEMENT DUST



Lawsuits between the orange growers about Riverside, Cal., and the cement manufacturers in that vicinity have been before the courts for years. The cause of the trouble lies in the fact that a fine layer of dust from the cement mills, so the citrus men claim, settles upon their trees and fruit and damages them to the extent of many thousands of dollars annually. And now electricity is called upon to end this dispute and bids fair to settle matters without putting either the mills or the orange groves out of business. A new device is now being installed at the Riverside Portland Cement Company's plant that will settle the dust and remove all cause of complaint.

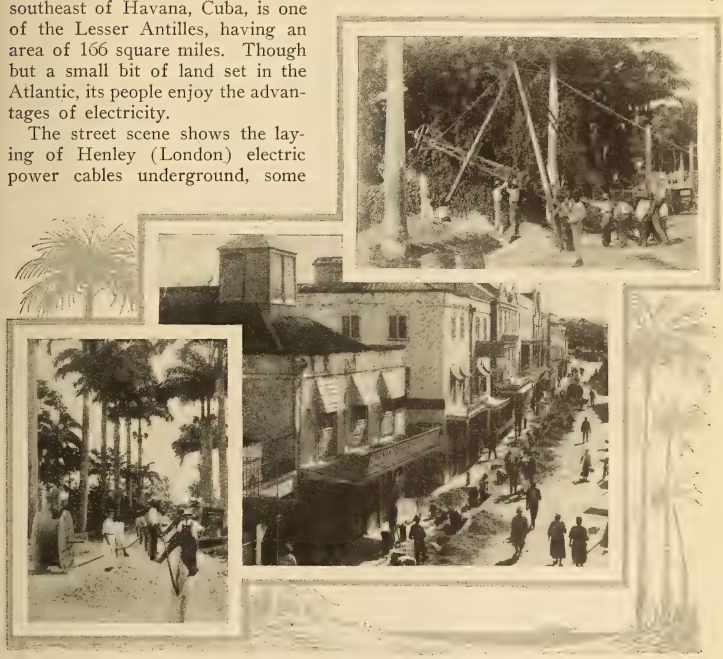
It is the invention of Prof. Cottrell of the University of California, perfected with the assistance of Walter A. Schmidt. The treaters will be installed at an expense of about a quarter of a million dollars, but the expense seems justified by the results of two test treaters which have been in successful operation for three months. All ten of the stacks will now be supplied with the device. While many of the details are not made public, the invention makes use of electric wires carrying 50,000 volts of direct current which has the effect of precipitating the dust from the stacks to a number of soft iron plates set at twelve inch intervals within the dust chamber. Thence the dust is drawn into bins placed below the treaters. The treaters are erected 80 feet

above the ground with a floor area of 60 by 200 feet and 2,400,000 pounds of steel will enter into their construction.

Laying Cables in Barbados

The island of Barbados, 1800 miles southeast of Havana, Cuba, is one of the Lesser Antilles, having an area of 166 square miles. Though but a small bit of land set in the Atlantic, its people enjoy the advantages of electricity.

The street scene shows the laying of Henley (London) electric power cables underground, some



LAYING CABLES IN BARBADOS

eight miles of this construction being now in service. In digging the trenches the soil was found to be full of coral formations.

In some portions of the island power is carried by overhead transmission lines. The type of pole used at the distributing stations which these overhead circuits enter is shown in process of installation. The native laborers are fairly intelligent and are good workmen.

Electric Seasoning of Wood

There is a method of seasoning wood through the agency of electricity which, in Europe, has been credited with much success. It is called the Nodon-Bretonneau process. The timber is nearly immersed in a tank of water containing ten per cent of borax, five of resin and a little carbonate of soda, and rests on a lead plate connected with the positive pole of a dynamo. Another similar plate, lying on the exposed surface of the timber, is connected with the negative pole. Thus a current of electricity can be passed through the wood from which all the sap appears to be removed, while the borax and resin take its place in the pores.

Electrical Interests of Women

EDITED BY GRACE T. HADLEY

A Valentine Tale

"I think I shall give a St. Valentine spread," announced Mrs. McGinnis to her husband, one evening early in February.

"Of course Mrs. Flannerty is invited," he observed.

"Of course she is not!" sniffed his wife with decided emphasis in the negative.

"Mrs. Flannerty not invited! Why, you are the best of friends!"

"Were," corrected Mrs. McGinnis.

"Have you fallen out?"

"Not exactly, but there is a coolness between us."

"What happened?"

"Well, it was like this. I had a first class colored laundress, you remember Susy, who used to work for me on Mondays and Tuesdays?"

"Very well indeed."

"Mrs. Flannerty openly lamented the fact that she could not get so good a laundress as Susie for love or money, so out of the kindness of my heart, I loaned Susie to her on Wednesdays —and now, what do you think?"

"It would be hard to say."

"Well, Susie has quit me almost entirely and works for Mrs. Flannerty. On Monday she washes there, Tuesday she irons, Friday she cleans, and Sunday she cooks dinner if the regular cook is out and she says that is as much work as she can do. You see how it is, one's best friend will often play a petty trick."

"The next time you get a good laundress," suggested Mr. McGinnis, sympathetically, "nail her down."

"What!" exclaimed his wife.

"Nail her down; fasten her in the laundry and don't lend her to your best friend."

"Then get me a laundress I can fasten down," suggested Mrs. McGinnis artfully.

"What!" exclaimed her husband.

THE VALENTINE

"Get me an electric washing machine. I might succeed in keeping that. To be sure, it may seem rather expensive at first but it saves in the end. I understand such a machine will be sent out on trial and a maid to demonstrate it. As to the cost, one pays so much down, and so much a month—" but Mr. McGinnis had disappeared behind the evening paper and conversation came to a sudden close.

On the morning of the fourteenth of February, Mrs. Flannerty's telephone rang vigorously. Mrs. McGinnis was at the other end, affable, agreeable and friendly.

"You must come over this afternoon to my St. Valentine spread; and what do you think? My husband sent me the funniest valentine you ever saw. By the way, how is Susie? Laid up with rheumatism, and you're without a laundress again! So sorry I can't lend you mine, but it's an electric washing machine and its permanently attached in the laundry. It's my valentine. Be sure to come over this afternoon. Good-bye!"

Cleaning Silver

The house-wife can "make" in her own kitchen enough electricity to clean her tarnished silver, and it will take very little "elbow grease." A few scraps of tin and zinc (I bought five cents worth at a stove and hardware store) a heaping tablespoonful of baking soda, the same amount of common salt and two or three quarts of hot water are all that are needed.

Place the tin on the zinc, in the bottom of a pan, put in the soda and salt, and pour over them the hot water. When the salt and soda are dissolved, immerse the silver in the liquid for two or three minutes and then take it out and rub it dry. Except in very obstinate cases, you will find the silver bright, after this bath and drying.

When all the silver is cleaned, remove the zinc and tin from the liquid and wash and dry them thoroughly.

Electricians would no doubt tell us that there is an electrolytic action between the zinc and tin in the solution, which is a reasonable supposition, since the salt and soda solution alone will not do the work. —Harriet G. Canfied.

Illuminated Flower Holder

A somewhat unusual lighting fixture in the way of a flower holder is shown in the illustration, its purpose being to provide

LIGHT IS TRANSMITTED UPWARD THROUGH THE DISH

subdued and pleasing lighting on a table or stand.

The entire holder is designed to be made preferably of glass which increases the artistic effect of the light upon it. Under the glass dish holding the flowers is an oval shaped translucent glass receptacle within which are incandescent electric lamps. The light is transmitted upward through the dish and downward through the translucent receptacle.

Electric Cooking

In the household there are two distinct kinds of heating required—the radiated heat for warming large air spaces, and localized heat for use in the cooking processes. Electric cooking offers the widest field for localized electric heat and there is no method which can be compared with the electric method. Instead of sending a good proportion of the heat up a chimney or into a room, while the small remainder does what it can to heat the cooking utensil, in electric cooking all the heat is concentrated in the place where it is wanted. The fundamental principle of electric cooking is that the heat is where it is wanted and nowhere else.

This is not the only advantage to which electricity as a means of cooking can lay claim; in addition to the fact that no heat is wasted going up a chimney or passing into the surrounding atmosphere, directly the heat is no longer needed, the current can be turned off and again there is no waste. Then too, heat can be obtained at a moment's notice and the cooking utensils are portable and can be carried from room to room as needed. An electric oven may be placed on a table so there is no need for stooping, but best of all, no dirt can accumulate on cooking utensils on account of combustion, and washing up is not such a disagreeable task as heretofore.

COOKING CONDUCTED WITH ALMOST MATHEMATICAL ACCURACY

Cooking with gas results in the formation of carbon on the bottom of the utensils making them very dirty, and as carbon is a non-conductor of heat, utensils so coated lose much of their usefulness.

With the use of electricity no carbon deposit is formed and all electric cooking utensils remain perfectly clean on the outside thus making less trouble for the housewife.

One of the special features of cooking by electricity is the uniformity of temperature that can be maintained. The heat can be regulated and it is not greater in the oven one day than another, and the bread that is baked in the modern electric oven is perfectly browned and perfectly baked at all times. With this most favorable characteristic the science of cooking by electricity can be conducted with almost mathematical precision.

Wonderful electric cook stoves have been invented that bear little resemblance to the old time ranges and they are automatic in operation. They are fit companions in science to the aeroplane and the automobile. The last and final step in the development of a modern method of cooking is the application of the automatic control feature. This improvement has eliminated much of the labor and drudgery of cooking. Imagine having in the house an automatic silent servant that will get up at any hour in the morning that may be predetermined and start the breakfast, heat the water, cook the cereal, cook the coffee, prepare everything correctly and keep it all in perfect condition until the family are prepared to sit at table.

The Art of the Housewife

At the twelfth annual vocational art and industrial conference, Mr. Carroll G. Pearse, superintendent of Milwaukee schools, declared that the art of the housewife is becoming increasingly difficult. Consider the situation of the young housewife who takes charge of a modern home. Her work is progressive. She is bound by necessity to acquire the arts of home furnishing and interior decoration; then there is the consideration of the commissary department, planning the meals and purchase of food; then in time come the children, and she must acquire some knowledge of the training of children; so, according to Mr. Pearse, the modern housewife is like a modern electric light plant that takes on an ever increasing load as night comes on.

New necessities in the home call for a necessary vocational training for boys and girls. As so many women assume the responsibility of home making, girls are now being taught the elements of home making in the elementary schools —the elements of cookery, making beds, setting the table, and the simple arts of the housewife—so that when they take on the increasingly difficult "load" they may be better prepared for it.

Veluria Glass Table Lamp

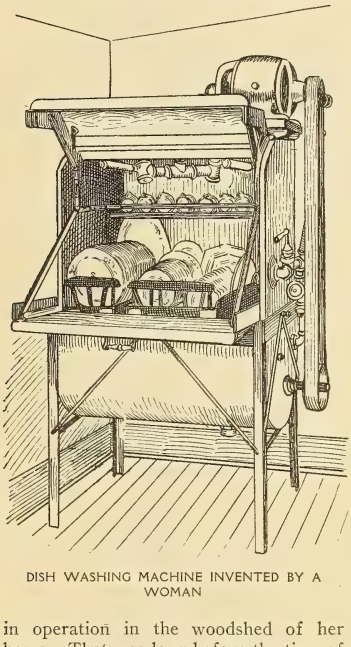
Those seeking something different in table lamps will find it in the Nelite portable. The base as well as the shade of the lamp is of Veluria glass. This glass is a pure white alabaster when not

SOMETHING DIFFERENT

lighted from within but when so lighted it takes on a faint blush or fire that is extremely pleasing. The decorations on the base and shade are deeply etched. Within the base is a small light which turns on with the light under the shade causing the base to glow and heightening the lamp's artistic appearance and richness.

Electric Power Dishwasher

That a dish washing machine could be made entirely practicable was an idea which had its origin in the mind of Mrs. Josephine Garis Cochrane 30 years ago. Two months after the thought occurred to her there was a little working model



DISH WASHING MACHINE INVENTED BY A WOMAN

in operation in the woodshed of her home. That was long before the time of the application of electricity to household appliances and she probably never dreamed at that time of a motor being applied to the operation of the device.

As time went on the dish washer was perfected, placed on the market and dignified by a trade name—the Garis-Cochrane. Then an electric motor became an essential part of it, performing all the manual labor necessary in cleansing the dishes.

The drawing illustrates the machine as it stands to-day. It is of considerable capacity and largely used in cafés, clubs, restaurants and similar places. But even in the household where the size of the washing is large enough to make it an economy it is finding a place.

The machine is handsomely finished in white enamel with nickel trimmings. As each dish has a place by itself in the wooden racks all breakage is prevented. The dishes are placed above the tank of heated soap suds and a pump submerged in the tank forces the suds over and through the dishes with great force. This process is thoroughly cleansing in itself and is discontinued by touching an electric button and stopping the motor. Then the clean, boiling hot water from the hot water supply is admitted through the automatic rinser which rinses and sterilizes the china, silver and glassware. They become so very hot that they dry instantly when taken from the machine.

An Ideal Bed Blanket

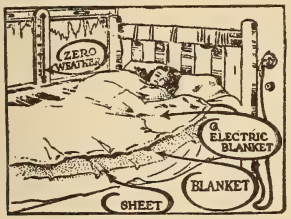
Everybody appreciates the great advantage to mind and body of outdoor sleeping; but everybody is not physically fit to enjoy outdoor slumber unless the necessary warmth of the body be insured by some special means. To-day the electric blanket makes it possible for everyone to gain all the refreshing and invigorating effect of sleep in the fresh air. With this blanket you can sleep on the porch or keep your bedroom windows open on the coldest nights in winter.

The blanket is intended for continuous operation and consumes only 50 watts. It replaces electrically the heat naturally radiated by the human body. A fine enameled wire is used as the resisting element and this is woven into the cloth of the blanket. There is no possibility of a shock as the wire is well insulated.

The best sateen is used in colors of old rose, red and blue. The blanket is soft

and flexible and may be folded in compact form.

The electric blanket should be covered with another light blanket to hold the



GOOD FOR ZERO WEATHER.

heat generated. The inventor, Mr. Russell Clapp, made the first blanket for the benefit of his mother and for use in their own home.

An Entered Apprentice and the Electric Laundry Machine

The back door bell rang and the janitor's wife appeared on the threshold, aggressive and authoritative, with arms akimbo.

"Did some one in this apartment put some clothes to soak down in the laundry?"

"Yes, I did," I faltered, guiltily.

"Well, take 'em out right quick and put 'em in the tub on the other side," she ordered, loftily. I flew down stairs and seizing the wet mass of clothes, hastily threw them into the middle tub on the other side before the janitor's wife appeared. It seems I had put the wash into tubs that she was going to use.

"You see," I explained, "I am not a regular wash lady and I did not know the rules of the laundry. In fact," I confessed, "I have never washed before. This is my first washing. I am about to become an entered apprentice and take my first degree." The janitor's wife melted immediately.

"Well, I dunno if I know what an entered apprentice is, but if you mean you don't know how to wash, why, I can tell you lots."

"Please do," I entreated. "I shall be so grateful." The woman beamed at me from over the dividing line. "Of course," I ran on, "I know that you soap 'em and souse 'em up and down and rub 'em on a board." The janitor's wife laughed heartily. "And then you bile 'em?" I asked. I remembered our colored laundress always "biled" the clothes.

"You're forgettin' the starch, ain't you?" inquired the janitor's wife. "I always put a little shaved candle into my starch," she explained, "and as long as I'm makin' the starch I'll starch a few pieces for you." I thanked her very kindly and from that time on our relations were most amicable. She regaled me with gossip about the other tenants, concluding with: "Most of our tenants go away for the summer. Are you going away?"

"I don't know yet. You see, I work for a living, not at washing exactly, but I wash today from sheer desperation. My washwomen have driven me to it. My laundry last week almost made me weep when it came home." The janitor's wife was keenly sympathetic.

"Sho' now they's lots of washwomen that ain't worth their salt, but I must say, there are no flies on you when it comes to washing." I surveyed my three lines of clothes with unmitigated pride.

"I should think you'd come down often and wash," she ran on, "seein' as how you've done so well. This is a good basement to work in."

"If all the tenants can afford to go away for the summer," I observed, "I should think they could afford to have an electric washing machine installed down here. I am inclined to think they would do so, if they did one washing with their hands. My hands feel like fury."

This suggested an immediate line of action. Suppose I secure the installation of an electrical washing machine. I figured that it would soon pay for itself in

rental to the other tenants. It would only be necessary to demonstrate its ability to wash quickly. The cost of washing in the old way is: 52 weeks at $2.00=$104. Price of good electric washing machine—$85. Difference for one year, $19. Instead of the backbreaking washboard, behold two levers, one to start the motor to oscillate the perforated cylinder, the other to start the reversible wringer. Instead of linen frayed and ragged out, you have a snowy pile of clothes, clean and whole.

The Proper Placing and Shading of Lights

In the lighting of the Twentieth Century home the problem is how to secure the right kind of light in the right place. Light should be steady, soft and evenly distributed. The incandescent filament must be carefully screened from the eye. Frosted glassware does this most agreeably. In large rooms there should be several sources of light. Wall brackets should always be within easy reach. They are used principally for the direct light that they give and should be provided with frosted bulbs.

A corner in the parlor of the Edison Twentieth Century Home illustrates these principles of properly placing and properly shading the lights.

The Lighting of Cafés

The lighting of a hotel, café or club—in fact, any place frequented by a large number of people searching for amusement, recreation or rest—presents its own peculiar phase of illumination. Dining rooms, palm gardens, rathskellers and

ILLUSTRATING THE PRINCIPLE OF PROPERLY PLACED AND SHADED LIGHTS

CAFÉS LIGHTED BY THE INDIRECT SYSTEM ARE KNOWN AS "COMPLEXION ROOMS"—VERY POPULAR WITH WOMEN

other classes of lighting must each be treated according to special requirements. Plans for lighting designed for general purposes would add little to the attractiveness or spirit of such places; it is essential that they receive special consideration.

Illumination to conform with the cordial atmosphere of such places must be cheerful, attractive and of a nature to place patrons in a receptive mood. The agreeable and inspiring influence of light has been recognized from the earliest days. Primitive man enjoyed his crude feasts under the light of flaring fagots; the Greeks and Romans depended upon the light from huge braziers to make their banquets places of pleasure and inspiration; the early Saxons and Britons gathered to their feasts by the light of torches placed in receptacles upon the walls of their lodges and castles; the pleasure loving French a few centuries later lighted their gatherings with chandeliers resplendent with candles and during the period just before our own, our ancestors had their pleasures by the light of candles or lanterns. Present conditions are so exacting, it is absolutely imperative that an abundance of light should always be available in public buildings; and where the light is, there will the crowd go.

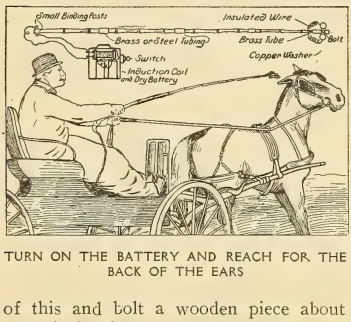
The most successful systems so far devised are those that furnish results which most nearly approach daylight conditions in quantity and quality of light and at the same time are convenient and economical. The almost universal adoption of incandescence electric lighting attests the fact that it has met these requirements with the highest degree of success.

Various cafés lighted by the indirect system are known as "complexion rooms" and in consequence are very popular with women.

Junior Section

Electric Starter for Balky Horse

Take a common bamboo, fish pole and cut it into lengths of about five feet. With a three foot bell hanger's bit bore a hole through the center of the pieces. Join the sections with brass or steel tubing. Insert two insulated wires through the pole terminating at the larger end in two small binding posts. On the other end of the pole place a brass or copper tube that will fit snugly and flatten it out slightly. Bore a hole through the middle



TURN ON THE BATTERY AND REACH FOR THE BACK OF THE EARS

of this and bolt a wooden piece about three inches long across the tube.

At the outer ends of the small cross piece fasten two brass or copper washers about an inch in diameter and attach the two insulated wires running through the pole, one to each. If a metal cross piece is used, one terminal should be insulated by a rubber or fiber washer. By means of a flexible wire attach the secondary of an ordinary shocking coil to the terminals at the near end of the pole. The coil and dry batteries of two or three cells can be carried in a small box on the wagon. When the horse is balky all you have to do is to turn on the battery, place the two terminals at the outer end of the pole back of the ears of the animal and it will go at once. This apparatus has been tried out by the writer on some of the worst balky horses and has never failed yet.—Edw. E. Harbert.

The Electric Crater

Everybody knows that an arc light is formed by causing an electric current to pass between the points of two carbon rods. One of these is called the positive and the other the negative electrode and the current passes from the former to the latter. Particles of carbon are carried off from the positive electrode until its end becomes cup shaped.

To the little cup thus formed the name of crater is applied and from this crater four-fifths of the light is emitted. The negative electrode does not become as hot as the other.

Between the two a little cloud of vaporized carbon is formed, rising from the crater, and this vapor gives forth a golden yellow light. But it is overpowered by the light of the crater itself.

The fact that most of the luminosity comes from the crater explains the reason why the light does not appear equal in all directions.

A very interesting effect is often noticed when flies or other insects flutter about an arc light. Their shadows cast on a neighboring wall appear gigantic. The reason is that the light of the crater is concentrated in a point smaller than the bodies of the insects and the boundaries of the shadows widen with distance.

Transporting an Engine by Cable

The ten ton traction engine is being transported on the cableway from the top of the canyon walls above Carson River to the bed of the stream more than

THE TEN TON TRACTION ENGINE READY FOR ITS CABLE RIDE

100 feet below. Without the cables it would have been necessary to build a road down to the river. These cables are built to carry a load of 20 tons and are operated by electricity developed in the government's power plant.

Magnetized Borers

It has been noticed in the Transvaal that bore holes driven to a depth of 500 to 1,000 feet show a strong deviation, which is generally toward the north. This is held by some probably to be due to the magnetization of the long stem of the boring tool, resulting from its rotation in the magnetic field of the earth. The south magnetic pole forms near the top and the north near the bottom. The effect of the attraction exercised by terrestrial magnetism is to impart to the rod a curve, with its convex side toward the south, and thus to produce a deviation of the hole toward the north, which becomes more pronounced as the depth increases. When the hole deviates in other directions than north, it is believed that the cause lies in the obliquity of the strata of rock that are traversed.

Native Telegrams in China

In China the transmission and receipt of telegrams in the native tongue is not so easy as is telegraphing in Western countries, since the Chinese language lacks an alphabet, expressing itself by means of ideographs.

The result is that, for purposes of telegraphing, an exact list of ideographs in quantity has been drawn up sufficient for ordinary correspondence and to each one of these ideographs a different number is given which is transmitted by the Morse telegraphic code. The Chinese code consists of some 9,800 ciphers, the whole forming a pamphlet of 49 pages, each one of which contains ten series of 20 characters with its corresponding number. On receipt of a telegram the operator looks up in his book the characters represented by the numbers transmitted.

Columbus and the Magnetic Needle

For many years the belief persisted that Christopher Columbus was the first to note the declination of the magnetic needle. In 1906, however, there were discovered three sun dials, dating from a time anterior to Columbus' first voyage and bearing upon the compasses accompanying them lines indicating the declination of the needle. One of these, found at Innsbruck, was made at Nuremberg in the year 1451. Not only has it an engraved line indicating the declination at the time of its construction, but shows other lines indicating subsequent changes of direction undergone by the needle.

THE ONLY EARTH ELECTRICAL CLOCK

DANIEL DRAWBAUGH

"It will run for a hundred years —more than that. If the bearings would not wear out it would in all probability run forever."

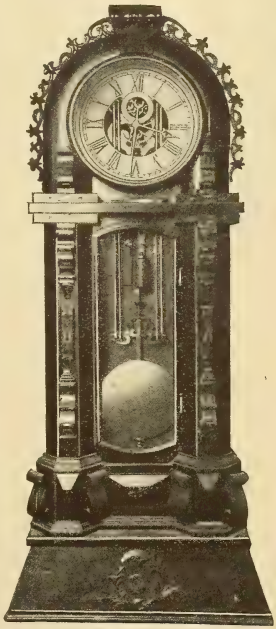
The speaker was not crazy, nor a perpetual motion crank. His statements were not the outline of some hazy dream invention yet to be, for there before us, ticking away merrily as it has continuously since 1870, stood the clock, physical and undeniable proof of the foregoing statements.

This wonderful timepiece stands in the office of Charles H. Drawbaugh, at Camp Hill, Pa. It was invented by Daniel Drawbaugh, the father of its present owner.

The clock is operated by electrical forces drawn directly from old Mother Earth. It requires no extraneous assistance, and all its units are self contained. Its principle is the nearest man has yet come to perpetual motion; time has proven this.

The working of this clock is simple. It has a heavy pendulum, about four feet long, weighing nearly 50 pounds. In the center of this pendulum, half way between the ball and its point of suspension, is fixed a permanent magnet. Behind this and fastened to the back of the clock's base is an electro-magnet the wires of which lead to the ground and are attached to metal plates which are buried and surrounded by cake, to hold moisture. This terrestrial battery never requires the slightest attention.

When the pendulum above described swings away from the perpendicular the poles of its magnets first attract and then repel, thus continuing the oscillation and making up for the natural reduction of force. The clock can be run so that it will not vary two seconds in a year.



DRAWBAUGH'S EARTH CLOCK, WHICH HAS RUN WITHOUT STOPPING SINCE 1870

Another remarkable feature about this clock is the fact that it has only four points or bearings that are subject to the least friction.

Daniel Drawbaugh invented many wonderful things besides this perpetual clock. Indeed, there are many of the older residents of Camp Hill who will stoutly assert that he was the first man to conceive the idea of an electric telephone.

However that may be, he was beyond a doubt one of those unfortunate beings—an unrecognized genius, upon whom publicity had never turned its all revealing beam.

Drawbaugh was a wizard for mechanical and electrical ingenuity. He invented hundreds of marvelously clever devices for furthering the world's work, and

was looked upon with a certain amount of awe by his fellow townsmen, as a superior sort of being.

Electricity in the '60's was in its swaddling clothes; hadn't its eyes open, so to speak, and one who dabbled with this mysterious "fluid' was regarded as a sort of necromancer.

So when Drawbaugh conceived the idea of a clock that would draw its energy from the vast reservoir of earth's potential electricity, he said nothing about the matter until the work was done and the clock was running.

Then he showed the result of his labors to wondering friends and proved to them that his clock ran all by itself. He showed them that there was no spring or motor anywhere concealed within the works, and that the motion was imparted by a ratchet and pawl operated solely by the pendulum. For over 50 years the clock has never stopped, never faltered, requiring no attention beyond a drop of oil now and then.

Simple Experiments With Electricity

From an ordinary newspaper cut a piece of paper 2½ by 3½ inches. Trim the corners. Warm the paper over a lamp or on a stove almost hot enough to make it smoke, then rub it over your hair, which should be dry. Use a little pressure when rubbing. The paper will now cling to any surface on which it is placed.

Small shreds or bits of paper are necessary for the second experiment. By taking a piece of paper and cutting a deep fringe on one side, then cutting at right angles to the fringe, one can quickly get a sufficient quantity. The pieces should be ⅛ inch square or less. Place the bits of paper on a sheet of paper that has previously been warmed in order to drive off the moisture. Again charge the piece of paper which was used in the first experiment, by heating and rubbing on the hair, then hold it from one to two inches over the bits of paper, and they will dance back and forth. This same experiment can be tried with a hard rubber comb if preferred. The comb, after being warmed, can be charged by combing the hair or rubbing with a piece of silk.—S. T. NASH.

A Magnetic Navy

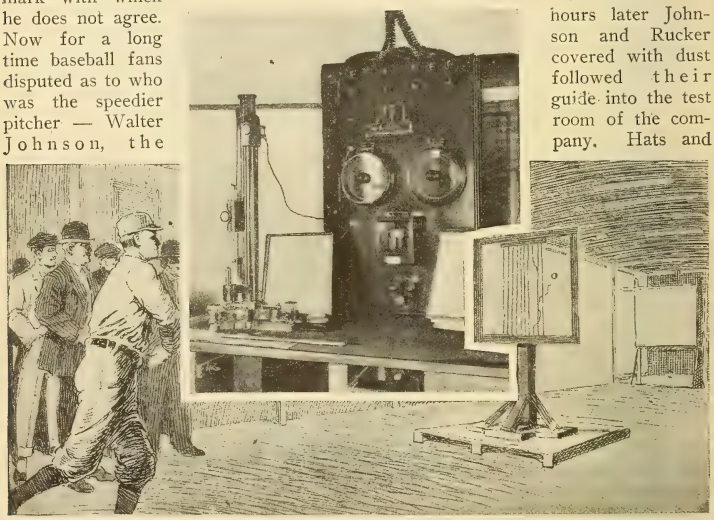
To build this navy thin pieces of cedar or pine wood and some magnetized sewing needles are necessary. Cut the pieces of wood into lengths a little longer than the needles used and about one-fourth of

THE MAGNETIC NAVY

an inch in width. Make one end of each boat pointed for the bow. After the boats are all ready turn them upside down and lay a magnetized needle upon each where the keel should be. Now light a paraffine candle and let a drop of hot paraffine fall upon each needle and boat. Take a hot nail and smooth the paraffine out over each needle. The boats are now ready to place in a large vessel of water where they will act very queerly toward each other. By holding a magnet near the boats they may be made to move about in a mysterious way.

Speed of Pitchers Tested by Electricity

Baseball fans are the strangest people in the world. One of their peculiarities is that each thinks he knows more than the other about the game. Also the fan being so extremely opinionated is quick to take exception to and dispute any remark with which he does not agree. Now for a long time baseball fans disputed as to who was the speedier pitcher — Walter Johnson, the blonde giant of the Washington American League Club, or Napoleon Rucker, a quiet Southerner who pitches with his left hand for the Brooklyn Nationals. Many disputes have occurred and an antagonistic spirit developed among friends. To settle the dispute, to hush it for all time, electricity was called into action. This is how it happened:

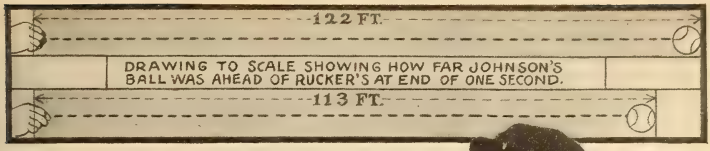


ELECTRICAL APPARATUS ORDINARILY USED FOR MEASURING THE VELOCITY OF BULLETS BEING UTILIZED TO TEST A PITCHER'S SPEED

Before the close of the league season when Washington happened to be in New York and Brooklyn was playing in its home city, an automobile chugged away from a Broadway hotel. There was nothing very unusual about that nor about its destination which was Bridgeport, Conn. But the men in the automobile were going to Bridgeport for one thing. And that was to conduct an electrical pitching test in the testing room of the Remington Arms Company.

A little over two hours later Johnson and Rucker covered with dust followed their guide into the test room of the company. Hats and coats were dispensed with and soon $75,000 worth of pitching material was propelling a ball to and fro in the air. For the benefit of those who are not fans and who do not understand the phrase "$75,000 worth of pitching material," let it be said that were Johnson and Rucker to be sold to other clubs their total prices would be $75,000. That sum is their worth to Washington and Brooklyn. So while the costly arms were unlimbering, the Remington people looked on curiously.

Their muscles ready, they glanced at



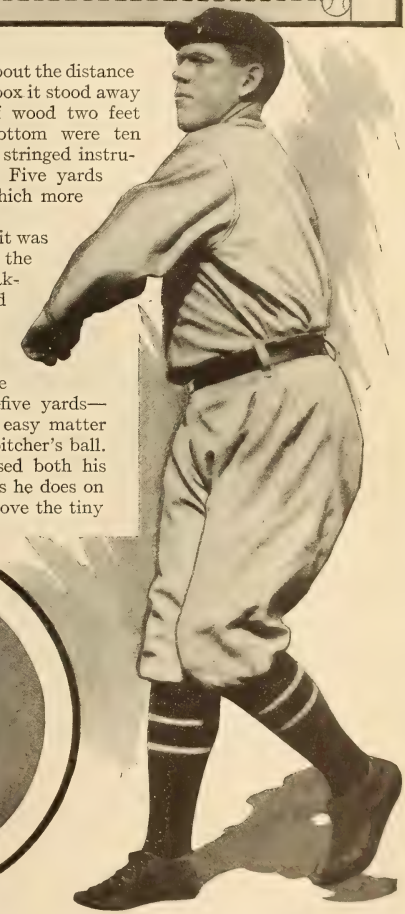
the electrical recording machine. About the distance of the home plate from the pitchers box it stood away from them. First was a frame of wood two feet square. Running from top to bottom were ten fine copper wires. It looked like a stringed instrument of some sort—an odd harp. Five yards behind it was a steel plate from which more wires led.

As Johnson made ready to pitch, it was explained to him that he must throw the ball through the wooden frame breaking one of the wires. This would record electrically the time the ball left the frame. Then upon striking the steel plate the other wires would record the time of its arrival. The distance between the two points—five yards—being known, it would then be an easy matter to figure the rate of speed of each pitcher's ball.

Johnson faced the line. He raised both his arms overhead clasping the hands as he does on the ball field, and swinging easily drove the tiny

Photo by Paul Thompson

WALTER JOHNSON



NAP" RUCKER

sphere from him. Now Johnson has good control on the ball field but he didn't have it up in the Remington place. Five times he threw before he could break one of the thin wires of the wooden frame. Then they made the readings, calculated his speed and found it to be 120 feet per second.

Then Rucker came to the line. He thought it would be easy to break one of the wires. After a first try he changed his mind. Time and again he let go of the ball before completing his swing. Missing the outside wire, he caused the horsehide to whistle harmlessly through the air bringing up against the steel plate without result. Finally he hit the mark, smashed two wires with a sweeping curve and found that the tester had recorded 106 feet per second.

On his second attempt Johnson increased his speed. Missing the wires twice he broke on his third attempt and found that his throw had been 121 feet per second. Again Rucker went through the motions of his delivery; again he broke a wire. So did his speed increase, climbing to 109 feet per second.

It was not until the last trial though, that Johnson made his record, drove the ball through the air 122 feet per second. Rucker bettered his mark too. But the best he could do was 113 feet. After the test was over Rucker said that Johnson had not thrown his best; that if he were to make the attempt in his baseball clothes and on the open field his record would be 150 feet. Then one of the company men told the pitchers that the new army revolvers sent a bullet 800 feet a second. Whereupon Rucker and Johnson fled to their car and hurried back to the city.

Convicts See Moving Pictures

With the prison gates still locked and with the guards as vigilant as ever, 500 convicts of the Joliet, Ill., penitentiary recently spent 30 deliriously happy minutes in the outside world of sunshine, joy and freedom.

And in that half hour of happiness men who had never seen a racing motor, a winging aeroplane, or a diving submarine, looked with wonderment at these commonplaces—to us without—of the Twentieth Century.

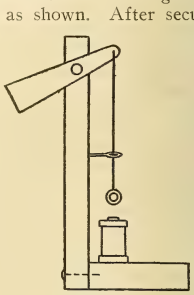
The "movies" did it. One whirring film machine in the darkened prison chapel brought about the 30 minutes of freedom and wonder to the men. Following glimpses of various bits of science which many of the men had never seen, flashes of European scenery, American skyscrapers and other strange things whirled before the childlike audience, many of whom had never even seen a motion picture.

"I didn't know there wuz sech things," said one "lifer" to Warden E. J. Murphy after the show.

"Well, there are, and lots more you haven't seen," replied Murphy.

Electrically Operated Toy Semaphore

Place a small electro-magnet upon a platform as shown. After securing the



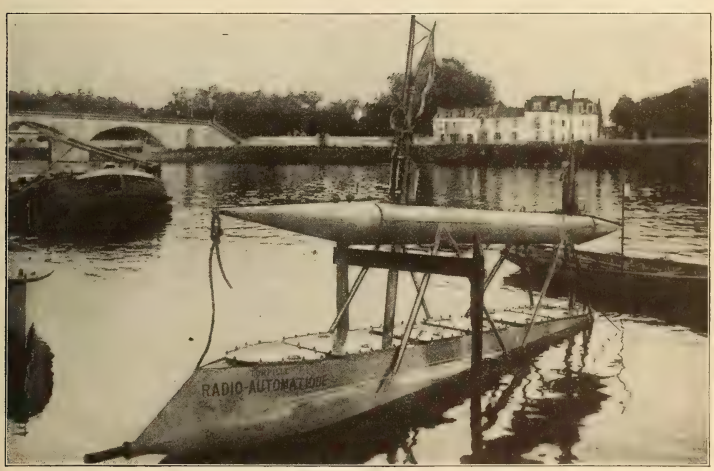
TOY SEMAPHORE

semaphore arm in place at the top of the post, fasten a string to it and pass the string through a screw-eye guide. To the lower end of the string attach a piece of soft iron which should be heavy enough so that when current passes through the electro-magnet the soft iron will be pulled down and the signal arm raised.

The Radio-Automatic Torpedo

The idea of controlling torpedos and small boats by means of wireless has engaged the attention of inventors for a number of years and particularly in foreign countries considerable success has attended the experiments. One of the most successful of this strange type of craft is known as the Radio-Automatic —a torpedo. It has been seen recently on the River Seine in France and the results attained with it are quite promising.

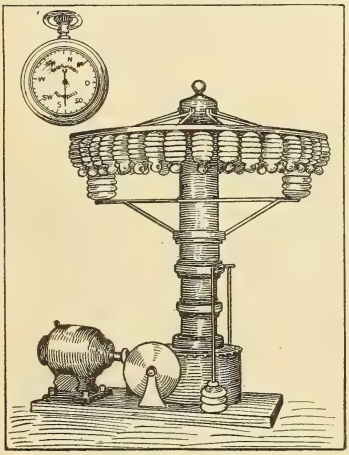
Ordinarily, the lower or torpedo part runs beneath the surface, and only the upper portion lies out of water. This part is a long, cigar-shaped cylinder, and it can even float on the surface, as it is water tight. It holds the electrical apparatus which receives the wireless signals and then sends the current in the proper way into the torpedo so as to work the propeller and rudder, raise or sink it or run it fast or slow. The wire which forms the antenna for receiving the waves is stretched between the two masts. On the rear mast is mounted a powerful acetylene lamp so as to send a beam back to the shore station and this beam has an electric shutter so as to make automatic signals and thus show how the apparatus is operating. Of course all the actual power for running the boat is supplied by batteries, the wireless waves simply controlling devices which turn on and off the current in the proper local circuits.



THE LATEST TYPE OF WIRELESS CONTROLLED TORPEDO

Telefunken Wireless Compass

With the new Telefunken wireless compass the direction of a distant wireless station may be found. To carry this out, the sending post is provided with a certain number of antennæ each of which sends out waves in a certain direction on the horizon, so that by connecting the apparatus onto antenna No.



THE WIRELESS COMPASS

1 the waves travel north, No. 2 to northeast, and so on. In reality there are used as many as sixteen different points of the compass.

To connect in each antenna in turn there is used a contact drum rotated by an electric motor. A separate antenna sends out a time signal in all directions. Just after the time signal is sent, the drum rotates so as to connect on one antenna after the other. At the distant station the operator has a watch device with a hand rotating around a dial at exactly the same rate as the drum. When he hears the time signal, he presses the watch button and the hand commences to rotate. At a given time, one of the signals comes in his direction and here the sound is loudest so that he stops the watch and now the hand points to the direction of the other station.

The time of each rotation is one-half minute and he can repeat the observations so as to arrive at an accurate result. It is said that the method is accurate to within three or four degrees.

Wireless Club Directory

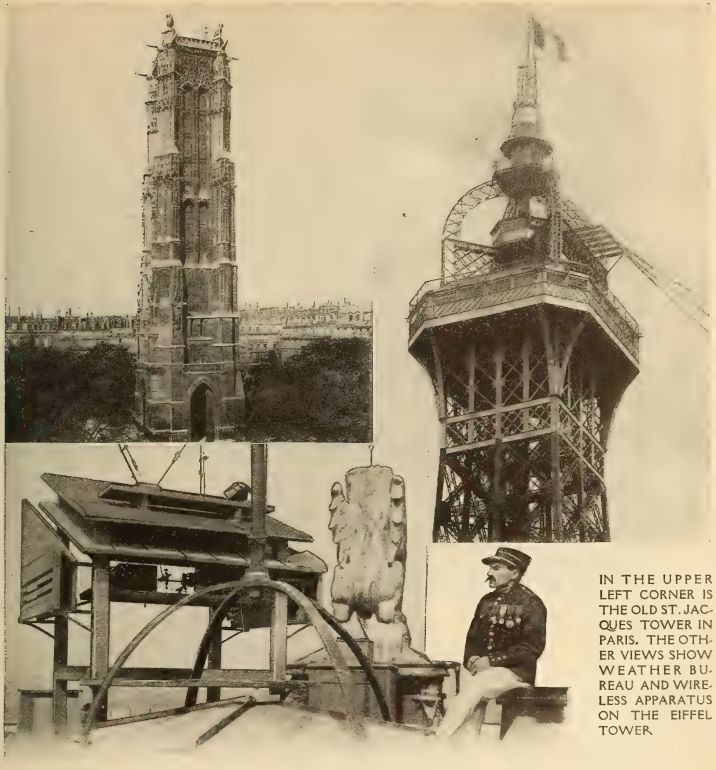
In the paragraph at the beginning of the Wireless Club Directory in last month's issue not all the readers of this department may have noticed that hereafter the directory will be published once a quarter instead of every issue. This directory is growing rapidly in size, and space cannot be devoted to it in every issue. As readers no doubt file their magazines there is really no necessity of running it oftener than once every three months, which permits of its being kept fairly up to date as to names and addresses of officers.

Correction

Referring to the article "How to Comply with the New Wireless Law" in the November issue, paragraph three states that experimenters having apparatus which is not powerful enough to transmit farther than the boundaries of the state in which the station is located need not take out a license. The Regulations require a station which can interfere with the reception of signals from outside the state in which it is located to have a license.

The fact conveyed in paragraph four should be that a receiving station only requires no license, no matter what its receiving radius may be.

On page 849 of the December issue the inductance of the "Standard Helix," should read "14.28 microhenrys," the inductance of a single turn is then approximately .29 mochrohenrys.



IN THE UPPER LEFT CORNER IS THE OLD ST. JACQUES TOWER IN PARIS. THE OTHER VIEWS SHOW WEATHER BUREAU AND WIRELESS APPARATUS ON THE EIFFEL TOWER.

WEATHER BULLETINS FOR FRENCH AIR PILOTS

In the future the air pilots will be able to fly under better conditions in France owing to the recent decision made by the war department in connection with the weather bureau. Weather bulletins and forecasts will now be received by telegraph in all the leading aviation centers which desire to have this news, and such news will naturally be received in the military aeroplane and airship headquarters above all in order to keep down the number of accidents to the officers. The weather news service has already started and the first bulletins were received at the Buc, Versailles, Rheims, St. Cyr, Pau and other headquarters during the latter part of October. The region of Paris is favored by having such a high point as the Eiffel Tower for making weather observations and at the extreme top there are mounted a number of instruments. The ancient St. Jacques Tower within the city is also one of the best equipped in this respect.

Aeroplane Wireless Experiments in France

During the recent French military maneuvers some interesting tests were made with improved wireless apparatus mounted on a Farman aeroplane. It kept up connection with a ground post when upon scouting flights, so that the enemy's movements could be observed and the distant post kept notified of the position of troops or batteries. The new Rouzet wireless apparatus was used on the aeroplane. While it is true that the other aeroplanes not equipped for wireless did some remarkable scouting work, the reports came in to headquarters much quicker when wireless was used.

As an example of what can be done under conditions of actual warfare, the Farman flyer started out on Sept. 16 towards the enemy's positions and observed all their movements in the region lying between Courcoue, Dange and St. Maure. The notes were sent back to the commanding general's headquarters at once after each observation without needing to wait until the aeroplane had made its whole flight. In this case the trip lasted for two hours, so that the first news came in one and three-quarters hours, sooner than it would have been delivered by an ordinary aeroplane.

The inventor mounted the aeroplane on some of the tests and states that the signals were good when flying as high as 5,000 feet and were not hindered by the fog. The apparatus was also installed by an under officer having but two months' training and he could handle it without any trouble, sending 900 words an hour. During the same maneuvers, signals were sent from airships to posts on the ground with great success.

PORTABLE GROUND STATION USED IN CONNECTION WITH AEROPLANE WIRELESS EXPERIMENTS

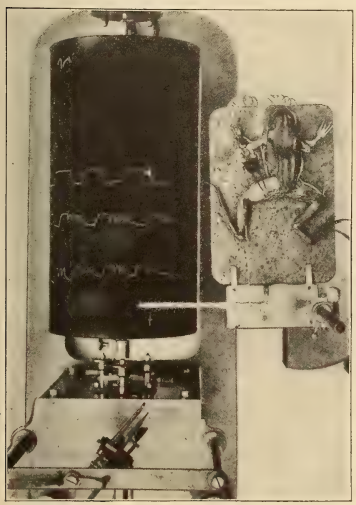
Setting Railroad Clocks by Wireless

Setting railroad clocks by wireless is a method which is likely to be quite useful in the future. It is beginning to be used by the Northern Railroad Company in France and the first wireless post is now installed at the station of St. Quentin, about 90 miles from Paris, so as to receive the time signals from the Eiffel Tower. A very simple antenna

is made up of two wires stretched upon the building and the whole plant did not cost more than $50. Once a day the telegraph operator receives the exact time from Paris and is thus able to set the clocks at the station.

The Frog Muscle Experiment

In the January issue we published a diagram and description of the interesting experiments made in the medical schools at Rennes with frog muscles and nerves, utilizing their sensitiveness to electrical impulses for receiving wireless signals. Since this was published we have received a photograph from Paris showing the apparatus in actual

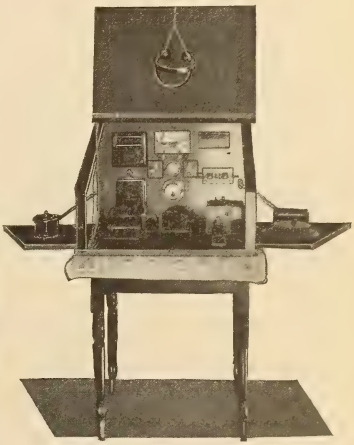


TIME SIGNALS EFFECTUALLY RECORDED THROUGH THE FROG'S MUSCLES

operation. In the picture is shown the smoked paper drum with messages recorded and at the right the mounted frog. At every spasmodic jerk of his leg the delicately mounted pointer is made to record the movement on the paper.

P. E. Wireless Club Member in South Africa

This picture of a cabinet enclosed wireless telegraph set was sent in by a member of Popular Electricity Wireless Club, Mr. R. Oxenhan, Durban, State of Natal,



WIRELESS SET OF A SOUTH AFRICAN CLUB MEMBER

South Africa. He writes: I have four friends who have installations and we have been experimenting together for years. The Postmaster General of South Africa will not allow us permits to continue our experiments. We have written off and on for the last year, and now are informed that we will have to do away with our installations on account of the interruption to the Durban Radio Station. I have been to see one of the prominent men in Durban, and he is going to help us with his influence in the Parliament, or from the Minister of Post and Telegraph. I might say we never had any intention to interfere with the above station. My mast is of bamboo, 62 feet high. My instruments are all home made except my receivers. At night I get signals from a 500 mile radius.

Questions and Answers in Wireless

By A. B. COLE

HELICES (CONCLUDED)

106. *In stations of what capacities should helices be used?*

The use of a helix is not advisable in stations where the power used is less than 25 watts. It is practically a necessity, however, where transformers or larger coils are employed.

107. *Give dimensions for a helix to be used in small stations.*

Diameter of winding—five inches; number of turns—10; size of wire—No. 10; kind of wire—copper or aluminum; distance between turns—one inch.

This helix is suitable for use with coils giving up to a one inch spark.

108. *What form of conductor is best for winding helices?*

Either a solid wire or a tube is to be preferred to metal ribbon as having no sharp edges from which brush discharge and consequent loss of energy can take place. Stranded wire is better than solid wire of the same outside diameter on account of having a greater surface and therefore less high frequency resistance.

CONDENSERS

109. *What is the purpose of a condenser?*

A condenser is used to vary the wave length of the circuit in which it is a part. In its action a condenser resembles a tuning coil, but the variation in the case of the former is one of capacity and in the case of the latter is one of inductance, both of these qualities affecting the wave length. The condenser and tuning coil differ, however, in that the condenser tends to advance the current with respect to the electromotive force and the tuning coil retards the current. This statement is true in dealing with alternating currents of commercial frequencies, and probably is also true in wireless circuits.

110. *What is a fixed condenser?*

A fixed condenser is one having a single capacity, that is, one whose capacity cannot be varied.

111. *What is the difference between an adjustable and a variable condenser?*

An adjustable condenser is arranged in sections, so that one or more sections can be used at will. A variable condenser is so made that gradual variation of capacity from one value (usually zero) to another value is possible. Fixed and variable condensers are generally used in receiving circuits and adjustable and fixed types are more often employed in transmitting circuits. Of the three above mentioned types of condensers, the variable is most desirable, but is used little in the transmitting station because of the difficulty of insulating movable plates carrying high tension currents.

112. *Describe the construction of a fixed condenser for receiving.*

A fixed receiving condenser may be made of a strip of good quality paper 3 by 45 inches and two strips of tinfoil each 2 by 40 inches. One strip of foil is placed on each side of the paper, leaving a margin of ½ inch on the edges. The three sheets are then rolled up tightly and secured in a roll. One wire is attached to each tinfoil sheet and these serve as terminals. Care must be taken that the foil sheets do not come in contact with each other as is very likely to happen if a poor grade of paper is used.

113. *Explain how to test a fixed receiving condenser for contact between the foil sheets.*

Connect the condenser in series with a battery lamp or a small battery motor and five or six cells of dry battery. If the lamp or motor operates, the foil sheets are in contact.

114. *How does alternating current pass through a condenser?*

Properly speaking, alternating current does not pass through a condenser. A condenser consists essentially of two con-

ducting surfaces separated by an insulating material, called a dielectric. If one of the conducting surfaces is connected to one wire of an alternating current circuit and the other surface is connected to the other wire, the one connected to the positive wire becomes positively charged as the voltage or potential of the wire rises, inducing a negative charge on the opposite surface. If the latter surface is large, considerable induced current will be required to raise it to the potential of the positive surface and consequently more current will flow to the positive surface as its potential rises. The current induced in the negative surface flows into the negative wire until the direction of the current reverses, when the same conditions take place in the reverse order.

It will therefore be understood that current does not really flow through a condenser connected to an alternating current circuit, but the transfer of current between the conducting surfaces is the result of induction. If the condenser were connected to a direct current circuit, practically no current would pass, for there are no variations of the potential of the direct current supply to speak of.

115. *Describe a fixed condenser for transmitting.*

Such condensers are generally in one of three forms: Leyden jars, molded sections and glass plate types.

The Leyden jar consists of a glass jar coated inside and outside with tinfoil to within two or three inches of the top. In the best forms the jars are electroplated with copper instead of tinfoil coated, as greater capacity is thereby obtained. The outer coating is one terminal of the jar and the inner coating the other. Connection is made with the inner coating by means of a metal chain fastened to a brass rod passing through the wooden top of the jar. Instead of coating the inner surface of the jar with foil, a solution of two ounces of common salt in one pint of water may be used, and in this event the chain dips into the solution.

Condensers for high tension currents are also made of metal sheets molded into a composition of high resistance and inductive capacity. The molding is done under hydraulic pressure of several tons. The Leyden jar and the molded type condenser are illustrated in Figs. 33 and 34 respectively.

Glass plate condensers for amateur use

Fig. 33
LEYDEN JAR

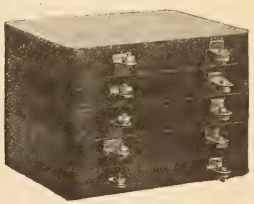


Fig. 34
MOLDED CONDENSER

are made by pasting or otherwise securing tinfoil sheets on both sides of plates of window glass or photographic plates, previously cleaned. The plates thus formed are set up in a wooden rack and alternate plates are connected together to form a complete condenser. The glass plate condenser has the advantage that variation in capacity is easily obtained by using more or less of the plates, but the glass described above is of a poor quality for this purpose as it contains lead salts which act as conducting media for high tension currents. Considerable loss is therefore found in these condensers and is easily observed in the dark as brush discharge of a purple color.

116. *Upon what factors is the capacity of a condenser dependent?*

The capacity of a condenser consisting of two flat sheets of metal separated by a dielectric is directly proportional to the surface of metal, the distance between them and the dielectric constant of the dielectric.

117. *How is the capacity of condenser measured?*

The most generally used method is to

use a standard variable condenser in connection with a ballistic galvanometer for comparison. The unknown condenser is charged to a certain capacity by means of a battery and is then allowed to discharge through the galvanometer. The standard condenser is then charged to the same potential and allowed to discharge through the galvanometer, and the capacity of the standard condenser is varied until the deflection produced by it is equal to that produced by the unknown condenser. Under such circumstances the capacities are equal.

118. *What is the resulting capacity of several condensers connected in parallel?*

The resulting capacity is equal to the sum of the individual capacities of the condensers.

119. *What is the resulting capacity of a number of condensers connected in series?*

The resulting capacity is the reciprocal of the sum of the reciprocals of their capacities separately.

Thus if condensers of ½, ⅓ and ¼ M. F. respectively were connected in series, the resulting capacity would be $1 \div (2+3+4) = 1/9$ M. F.

The Brush Discharge

The term "brush discharge" to the wireless experimenter usually conveys the idea of the luminous electrical discharge so frequently seen at the edges of the tinfoil in the ordinary glass plate condensers. Of course this type of discharge is by no means only found in connection with condensers.

It is, in ordinary air, of a purplish violet color. To the unaided eye the discharge seems quite complicated, but those who have access to a Wheatstone rotating mirror will see not only one image of the brush, but several, arranged in succession and at regular intervals. Each interval corresponds to a single discharge. The complexity of these discharges is really due to the length of time taken for the retina of the eye to absorb their luminosity and for it to fade again.

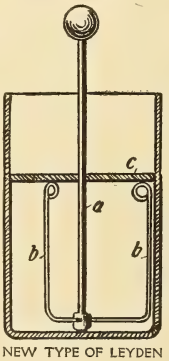
The brush is generally accompanied by a hissing or crackling sound, and in some cases a musical note. The tone or pitch of the discharge may be made to rise considerably if the hand or a conductor of fairly large surface be brought near.

An air current, if properly directed, will convert a brush into a glow. This glow is produced by the constant passage of electricity through a small portion of air in which the tension is very high so as to charge the surrounding particles of air, which are swept off by the "electric wind," which forms a most essential part of this phenomenon.

Increasing the power, diminishing the discharging surfaces and rarefaction of the air favor the production of the glow.

Improvement in Leyden Jars

An improvement in the way of fixing the metal rod of a Leyden jar has been brought out by a Berlin firm. In the usual methods, the rod runs through the cover of the jar which is of cork, wood or other material, but in the new design the rod (a) is held in place by a set of three springs (b) as will be noticed and the springs support the ebonite cover, being at the same time well pressed against the inside tinfoil coating of the jar. Thus the springs serve to give a good contact with the tinfoil and the rod is held upright in the middle and in a tight position. Owing to the new Blume method the rod can never fall over to one side, as is often the case where it is run through the cover of the jar.



NEW TYPE OF LEYDEN JAR

For Practical Electrical Workers

Motor Boat Ignition

By GEORGE MADISON

It is a well known fact that over 85 per cent of gasoline engine trouble originates in the ignition system. Motor boat owners who understand this very important part of their engines will fully appreciate how very necessary it is to keep their ignition systems always in perfect order and it is for the benefit of these as well as for their more advanced shipmates that I have undertaken to give a few ideas on the subject of ignition.

For those who are in doubt as to the value of correct ignition, I am going to tell of a few of the troubles which are due, sometimes if not always, to the ignition system, and many readers will doubtless recognize troubles for which they have "pulled" their long suffering carbureters, dismantled their circulating pumps and perhaps the entire engine, only to have the engine start off from no apparent cause and in due course of a few minutes stop again from the same cause.

Eight out of twelve of the principal causes why an engine fails to start are due to the ignition: (a) Weak batteries. (b) Short circuit on the wiring system. (c) Broken wire. (d) Broken down coil. (e) Corroded connections or switch. (f) Fouled spark plugs. (g) Switch not on or fails to make contact. (h) Timer out of time.

Five out of nine of the principal reasons of an engine missing explosions are due to ignition: (a) Defective or dirty spark plugs. (b) Loose connections. (c) Weak battery. (d) Sticky vibrator on coil. (e) Poor contact on timer. (Advancing the spark too far will also cause the engine to miss fire.)

Base explosions are due to two causes usually and the remedy is to turn on more gasoline and set the spark a little earlier. The ignition system is often to blame for the sudden stopping of the engine after running in good shape for some time. These troubles may be caused by: (a) The spark plug getting wet and short circuiting. (b) Some loose tool, tin funnel or measuring cup or water throwing a short circuit across the terminals of the coil. (c) Some object holding the vibrator. (d) The switch being accidentally kicked open. (e) The water in the bilge may have shorted or grounded a wire or wires. (f) The connection between battery cells may have been broken or pulled off. (g) The insulation on the spark plug may have broken down. (h) The ground wire on the engine may have been pulled or broken off.

WIRING.

When wiring up an ignition system on a motor boat, great care should be taken to obtain the best of material in accordance with the old saying that "The best is none too good." This holds particularly in this connection, as safety may some time depend upon the engine working without a kick when in a heavy seaway or swift current. In the matter of the selection of the spark coil it is best to purchase a standard piece of apparatus from

some reliable dealer whose advice may be depended upon even at a little higher price than is asked "by some fellow down the river" for a secondhand one "just as good as new." You are then nearly sure that the apparatus is right and in perfect condition; and if trouble ever does show up in the coil, you can get a new part or send it to its own factory to be repaired.

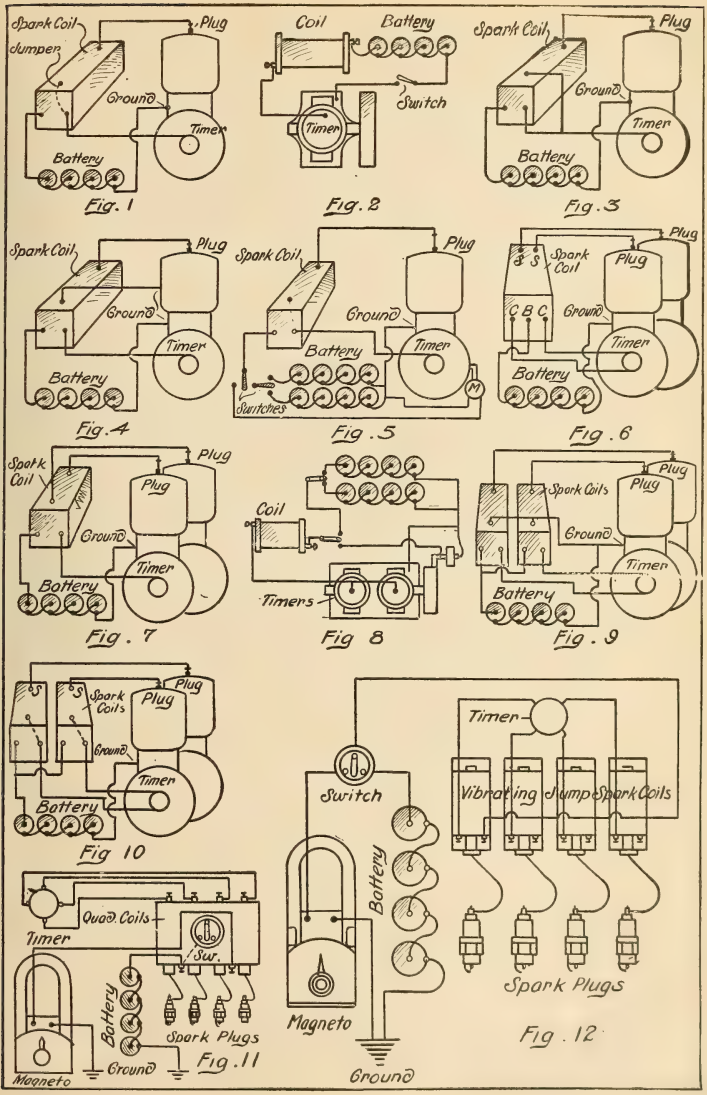
Spark plugs should also be purchased from a reliable dealer who will tell you the truth regarding them, as there are a great many of them on the market and all are claimed to be the best. Personally the writer likes a porcelain plug, as the mica plugs while less liable to mechanical damage are very apt in a comparatively short time, to soak up enough oil to short the plug through its insulation. I also like a plug having as few curves and angles as possible, as these do not foul up so quickly if too much lubricating oil is fed into the cylinders.

The switch may be of the knife type or a regular round, hard rubber, two or three point, battery switch. The two point will control two sets of battery or a battery and a magneto, while the three point will control two sets of battery and a magneto. The latter type is and has been giving me perfect satisfaction, as the switch points have little recesses, or cups, into which a little projection on the lever fits thereby insuring a perfect connection no matter how rough the sea. The knife type has one advantage, however, where appearance does not count and that is that it is impossible to throw the switch off unintentionally by brushing up against it. The switch is always cut into the ground wire of the circuit.

The wire itself should be the very best obtainable, as a poor insulation will harden and crack very quickly upon being exposed to the air, dampness, heat and oil to which all ignition cable is exposed. The insulation will break down and allow the current to escape to ground through other channels than the intended ones and thereby cause considerable trouble. The French make of solid rubber insulation is supposed to be the best but I have tried them all and have come back to the Packard. The insulation on this cable is not solid but is built up of insulated fabric and thick layers of black and white rubber. All wire should be run in the most direct manner possible; should be securely fastened up with little fibre cleats such as telephone wiremen use; should never lay on top of one another and must never run under the flooring where there is dampness to rot the rubber.

The current for the system may be obtained from several sources as follows: dry cells, wet cells, storage batteries and magnetos. The dry cell battery is without doubt the most popular and is usually used in sets of six cells. These cells make the most economical form of battery, as they are not only cheap in first cost but are long lived and on the whole dependable. They are also desirable on account of their comparatively light weight and the fact that they may be hung up or laid in any position and take up very little room. There is also a waterproof guaranteed battery on the market termed a multiple battery which is guaranteed for an entire season. The writer used one of these multiple batteries in connection with a six cell dry battery and did not call upon the dry cells to do any work last season except to try them out once in a while to see that they were in good working order. Wet batteries will give very good satisfaction if room, weight and dirt are not objectionable. There is, however, a wet battery on the market which gives good satisfaction. If you are going to use this as a source for your electric current, get the one that has a rubber top which prevents the liquid from slopping around when the boat is in a seaway, which retards the creeping of the battery salts, and which delays the evaporation of the liquid. But wet cells are cumbersome and troublesome at best.

The storage battery which has become


Spark Coil
Plug
Jumper
Ground
Timer
Battery
Fig. 1
Coil
Battery
Switch
Timer
Fig. 2
Spark Coil
Plug
Ground
Timer
Battery
Fig. 3
Spark Coil
Plug
Ground
Timer
Battery
Fig. 4
Spark Coil
Plug
Ground
Timer
Battery
Switches
M
Fig. 5
S S
Spark Coil
Plug
C B C
Ground
Timer
Battery
Fig. 6
Spark Coil
Plug
Ground
Timer
Battery
Fig. 7
Coil
Timers
Fig 8
Spark Coils
Plug
Ground
Timer
Battery
Fig. 9
Spark Coils
Plug
Ground
Timer
Battery
Fig 10
Quad. Coils
Timer
Sw.
Battery
Spark Plugs
Ground
Magneto
Fig. 11
Timer
Switch
Vibrating Jump Spark Coils
Battery
Spark Plugs
Magneto
Ground
Fig. 12

so popular with autoists is not of so much value in a motor boat unless the boat is equipped with a charging dynamo, as the battery is exceedingly heavy and must be carried to a garage to be charged. I have run a single set of dry cells all season and have seen storage battery after storage battery play out in from one month to six weeks. This probably was due to carelessness or ignorance but it is a fact nevertheless. If the boat is to be used around home waters where the garage is ever handy, the storage battery is fairly good, but if you are going on a cruise get dry cells.

The magneto is a handy machine to have on any motor boat. The magneto should not be relied upon too much, however, in wet or stormy weather unless equipped with a hood to keep off the rain and spray. A low tension magneto will not only take care of the ignition with ease (a battery being required only to start the engine) but will also care for the lights as well. I have a friction driven magneto that not only supplies the lights and engine, but operates the electric horn as well.

In connecting up a set of dry cells care should always be taken to have the wire coiled between each cell so that there will be no trouble from broken connections.

CARE OF IGNITION OUTFIT.

The best way to take care of the battery, coil, etc., is to separate the individual cells with pieces of cardboard well shellaced (it will do no harm to shellac the cardboard cartons on the dry cells themselves). Everything should be securely fastened in a box or locker. This locker should have a good lock and be absolutely waterproof. If the boat is used but little it is well to place the ignition outfit in a box, so that it may be taken ashore when not in use, thereby insuring the outfit against dampness and damage.

In an open boat when bucking up against a heavy sea or when it is raining, a piece of oiled canvas should be stretched across between the combings and over the engine. This will protect the plugs from the water and also keep the dampness from the carbureter.

MAKE AND BREAK VERSUS JUMP SPARK.

When gasoline engines were first used they were equipped with the make and break system of ignition, but at the present time the jump spark system is the most generally used, although the make and break is much more simple and altogether better adapted to rough work.

The make and break ignition is especially adapted for open boats and fishing craft because the damaging elements of water, moisture and salt air which are so detrimental to the jump spark, have no terror for the make and break.

It is a recognized fact that the jump spark when properly installed and cared for is efficient and therefore it will be this style of ignition with which this article will deal principally.

There are various ways of wiring up an ignition system, as may be seen by the following illustrations. After selecting the diagram which meets your requirements, it would be a good plan to enlarge the drawing on heavy paper, or make an enlarged tracing and have it blue printed on cloth and fasten it on the inside of the cover of your ignition locker or box. This may save you considerable trouble until you get perfectly familiar with the various connections.

Fig. 1 illustrates a three terminal coil connected up for use on a one cylinder engine.

Fig. 2 explains a make and break connection for a one cylinder engine.

Figs 3 and 4 describe a method of wiring four terminal coils on a one cylinder engine.

Fig. 5 shows a wiring system for two sets of battery and a magneto on a one cylinder engine.

Fig. 6 illustrates a five terminal coil wired for use on a two cylinder engine.

Fig. 7 shows a single four terminal coil connected up to a two cylinder engine.

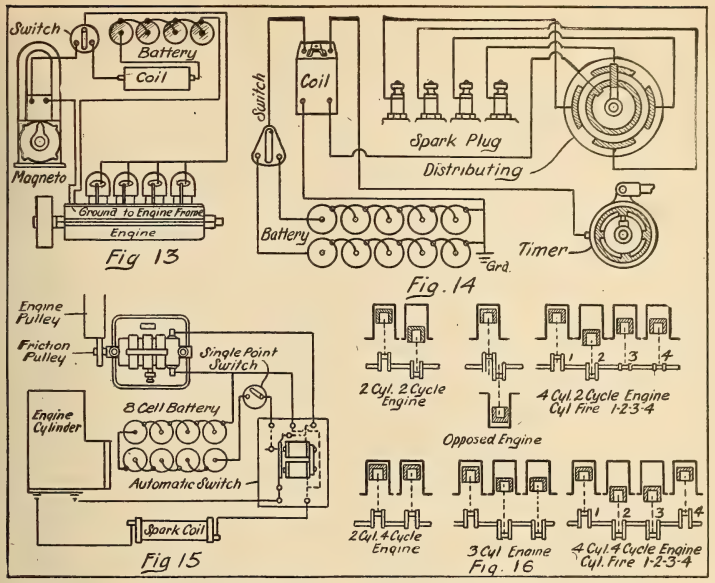


Fig. 8 describes a make and break system on a two cylinder engine.

Fig. 9 explains a two cylinder engine using a separate coil for each cylinder.

Fig. 10 illustrates two three terminal coils in use on a two cylinder engine.

Fig. 11 shows the connections of a four cylinder engine using a four unit coil, a timer, a magneto and a battery. This system may be used for any number of cylinders by using the proper coil.

Fig. 12 illustrates the connections of a four cylinder engine using a magneto, a battery and separate coils. This diagram is adaptable for any number of cylinders from one to a dozen.

Fig. 13 describes magneto, spark coil and battery connected up for a four cylinder make and break system. Any number of cylinders may be connected up in this way.

Fig. 14 illustrates a single coil connected up to a four cylinder engine and using a distributer. This system is known as the synchronized jump spark ignition.

Fig. 15 shows a primary spark ignition circuit containing a magneto generator, an eight cell chemical battery, and an automatic cut-off or relay.

On some two cycle marine engines there is an insulated button on the timer handle to which the ground wire is attached instead of to the frame. This is a handy rig as the engine may be stopped by pressing this button and breaking the circuit. This feature is especially appreciated when used on an engine which is without a reverse gear, as the spark can be retarded until the engine is nearly stalled, the button is pressed, the timer thrown quickly to the other side of the quadrant and the button released. The engine is now reversed. This method will not always work but the trick can be accomplished about once out

of three times if the operator is real expert at it. Don't let anyone talk you into running your boat without a reverse gear. Every time the engine is reversed on the spark it is a body blow to its health and a few times is liable to do so much damage that it will cost more than the price of a reverse gear to put the engine in shape again.

TROUBLES OF A JUMP SPARK SYSTEM.

If high tension ignition is used you can tell by the sound of the engine whether the missing appears to be confined to certain cylinders. If it is, the cylinders at fault may be quickly discovered by holding down the vibrator of one or more of the coils. If all but one of the vibrators are held down the engine will stop if this one cylinder is not working. When the faulty cylinder has been thus traced, open the pet cocks, retard the spark and turn the engine over slowly by hand until the desired vibrator buzzes and note if the buzz is clear. If the sound is not clear and steady adjust the contact screw by turning slightly. If the spark is much more feeble than that given by the other coils but there is no arcing at the contacts and the vibrator is adjusted as well as possible, the coil is probably short circuited and should be returned to the factory. It stands to reason that this method is not adaptable to a one cylinder engine.

If the vibrator and coil are all right, the spark plugs are probably sooted. With some engines and some plugs this is a very common occurence and the plug is the first thing to be examined. If the plug is clean it is still possible that the porcelain is cracked internally or that the mica has absorbed oil enough to throw a short across it. Try a new plug or exchange the plug from another cylinder. If the cylinder still misses look over the cable for leaks due to water or defective insulation.

If a synchronized jump spark is used, Fig. 14, the symptoms of the different possible troubles will be about as above with the exception that the local misfiring can only be due to leakage in the spark plugs or spark plug cables or to bad insulation in the distributer itself. The latter may be due to water or dirt or metal particles and would not appear if the distributer is kept clean. As the vibrator for all the cylinders is the same one, it requires considerable attention since it has from two to six times the work to do that the ordinary vibrator has in the other systems.

Much of the trouble with spark plug sooting may be avoided by not racing the engine when idle, as the high speed causes the oil in the crank case to splash up onto the cylinder walls and into the plug. This oil is then carbonized by the heat of the explosions causing the short circuits in the plug and making the engine misfire.

TIMING AN ENGINE.

If there is one thing more than another which the average motor boat owner hesitates to tackle it is timing his engine. This is not the difficult job that it is generally supposed to be until it comes to a four cylinder, four cycle engine. The reason that the latter is complicated is because there are so many marks on the flywheel that it is hard to distinguish which is which.

If the engine is a single cylinder, two cycle affair the timing is comparatively easy. The spark plug is removed from the cylinder and the flywheel turned over until the piston is at the top of its stroke but has not gone over the center. A mark is then made on the flywheel and the timer set so that the explosion takes place at just that point of the stroke. The reason for setting the spark just before the piston goes over the center is because a charge of gasoline does not explode instantaneously but requires an appreciable length of time; therefore, if the piston has gone over the center before the explosion takes place the full effect of the charge is lost and only about one-half of the impluse goes into the power stroke.

If the engine is a two or more cylinder, two cycle machine the position of each piston is marked on the fly wheel and the timer contacts set accordingly and the cylinders explode in order.

In a four cycle engine, however, the job is more difficult, as not only is the position of each piston marked on the flywheel but also the position of each inlet and exhaust valve. This naturally makes a good many marks on the flywheel and brings many of them very close together. The timer is set in accordance with the pistons and the valves are set by changing the position of the cams on the cam shaft.

Fig. 15 shows the different arrangements of the crank shaft and the position of the pistons which will show very clearly how the timer should be set for each kind and size of engine.

IGNITION DON'TS FOR MOTOR BOATMEN

Don't try to start an engine with worn out batteries.

Don't try to run an engine with soot fouled spark plugs.

Don't let batteries get wet.

Don't run wires through bilge water.

Don't let wire connections get loose.

Don't stop the motor and leave the charging switch in contact.

Don't let bare wires come in contact with the motor.

Don't let wire terminals get loose or corrode.

Don't forget that 85 per cent of motor failures are due to electric trouble.

Don't fool with the spark coil. The vibrator is adjusted at the factory and seldom needs readjustment.

Don't screw the vibrator contact too tight or it will burn out the contact points. Get a new battery.

Don't expect satisfactory results from a poor or worn out battery.

Don't try to start the engine without making sure that the spark lever, commutator or timer is retarded.

Don't try to start an engine without closing the switch.

Don't put a wrench on the upper nut on the spark plug when the plug is in the engine. You may ruin the plug.

Don't screw a spark plug tightly into a cylinder when the latter is hot. You may not be able to get it out when the engine cools off.

Don't forget to throw out the switch or pull the button and put it in your pocket when not running.

Don't expect the engine to run with loose wire connections, weak batteries, dirty spark plugs or poorly insulated wire.

Don't think it a waste of time to clean off the ignition points occasionally.

Don't adjust the carbureter as soon as the engine works badly. Look at the ignition system first.

Don't pile anything on the batteries or coil.

Don't conceal wiring under the floor.

Don't have a leaky battery box and don't keep it in an exposed place.

Don't use a single set of batteries; series multiple last longer.

Don't forget the ammeter if dry cells are used.

Don't forget to carry an extra spark plug, a vibrator for your spark coil, some extra ignition wire, a small piece of fine emery cloth for cleaning your plugs, a fresh set of battery and a large quantity of common sense when going any distance from home in a motor boat.

From the foregoing article it will be seen that the electrical end of the gasoline engine has much to do with the actual smooth working of the engine, and when a motor boatman conquers the electrical part of his engine he may go cruising without fear or favor, providing, of course, that his gasoline tanks are full and the lubricating oil is running right.

Protectors of the Network

Electric current for light and power is almost universally distributed as alternating current. This current at a high voltage or pressure is sent out from the power plant to distributing points in the various localities served. Here the current is passed through transformers which "step down," that is, reduce the voltage sufficiently to make it safe to be used for household and ordinary power purposes. A transformer is capable of serving a group of customers, the lines running out in all directions from the low voltage winding. All of these transformers in a given district are interconnected to form a network, both the low voltage and the high voltage mains which are entirely separated and distinct from each other, being so interconnected. A network will then form the source of supply for all the customers in the district, the transformers dividing the load among themselves.

This system takes advantage of what is called the "diversity factor" of the customers' demands. That is to say, since the customers will never all demand their maximum of current at the same time, the total capacity of the interconnected transformers need not be as great as would be the case if each customer required an individual transformer as was once common practice.

But even the interconnected system has a disadvantage. In case of one transformer burning out or in any other way causing a short circuit on the line the primary fuse on that particular transformer is at once blown, dropping that unit out of the network. The load which this transformer was carrying must now be carried by the other transformers. And in addition these transformers must take care of what is called a "short circuit current" which the crippled transformer will draw from the network.

On account of the resistance of the various cables connecting all the transformers, the drop on the line, as engineers would say, the transformer nearest the disabled one will now take up most of the additional load and its fuse in turn is likely to let go. Therefore, it is quite possible that all of the transformers in the district will one after another blow their fuses after the first one has been disabled.

This is one of the hundred and one things which may happen to a distribution system which the general public seldom takes into consideration in passing judgment on the company's service. But let it be remembered, however, that there are a great many things like this that might happen and that no sooner does the possibility arise than someone must set to work to design a remedy in anticipation.

In this case a remedy has been devised which is called a network protector, designed by the Metropolitan Engineering Company of Brooklyn, N. Y. It is beyond the province of an article in a non-technical magazine to explain the details of its operation. Suffice it to say that the protector is in itself a little transformer so connected to the primary and secondary distributing mains that it acts as a delicate electrical balance. When everything goes all right the protector plays no part, but as soon as the transformer to which it applies gets into trouble the protector "gets busy" and cuts the transformer out of the network instantly, and by reversing the polarity of certain coils actually gets electrical pressures within the sick transformer to opposing the destructive short circuit current above alluded to from rushing into it out of the surrounding network. With this short circuit current killed even before it can start the other transformers on the system can safely take on the work which the disabled one has dropped and continuity of service is preserved.

Advantages worthy of note are that the protector is entirely electrical, positive in action, free from moving parts and requires no attention or adjustment.

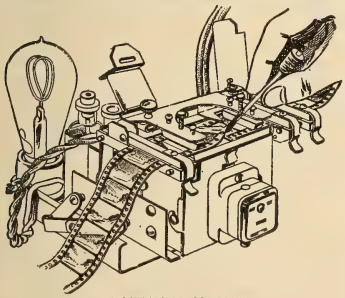
This is but one example of scores and scores of wonderfully designed and constructed protective devices found in every

nook and corner of an electrical generation and distributing system, and all designed to do away with the human element in every way possible.

We all insist on continuous service. We are apt, many of us, to raise an outcry if our lamps flicker for a moment or if for two seconds they should go out all together even if that were to happen but once a year. But is it not well at the same time to give a thought to what might the state of affairs have been if millions of money and the best engineering brains of the country had not been expended in developing these intricate, automatic devices which hold the electric force in check and control it to a nicety?

Film Mending Machine

Every moving picture operator knows from experience under what trying conditions a film sometimes becomes torn or broken and how the film must be scraped and the torn edges trimmed down evenly so that a perfect joint and perfect registration of the perforations along the edges may be obtained in mending it.

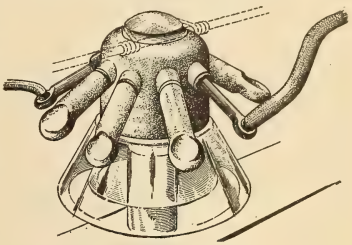


FILM MENDING MACHINE

The invention of Edward J. Schafer, Seaside, Oregon, provides for a repairing machine attachable to any rewinding machine and arranged to swing out into the film's path when needed. A transparent plate with a light under it clamps the scraping and cutting mechanism.

Odd Current Distributing Insulator

This illustration, looking something like the picture of an octopus, is a petticoat insulator made so that wires may be connected to it for branch circuits. The insulator has a threaded top upon which may be placed a metallic ring having a number of projecting insulated arms to which wires are connected by soldering, screwing or riveting into the eyes. A patent on the device has been granted to Ernest H. Knutz, Arcata, Cal.



OCTOPUS INSULATOR

The Electrician's Stationery

Any man in the electrical business should pay attention to the quality of his stationery and the printing of the same, for the character of an electrician's workmanship and his standing are judged to a considerable extent by the writing materials he uses. A good crisp bond paper, either white or tinted, of the regulation typewriter size, is the best material for practical use.

Heed particularly the letterhead. Here is an opening for originality in the arrangement and wording of the printed matter. Try to simplify the wording so that it shall be neat in appearance, concise and comprehensive.

Whatever the style of the letterhead may be, the envelopes must be of the same paper and the return address printed in the manner characteristic of the letterhead, though on a reduced scale.

Heat Cells

The problem of converting the energy of coal directly into electricity without the intermediate use of steam engine and dynamo is one of tremendous importance. After 50 years of effort it has not been solved and may never be but the remote chance of success justifies the effort.

Less than ten per cent of the energy in coal is converted into electric or other power by present methods of burning the coal under a boiler. The loss each year amounts to untold millions of dollars.

As far back as 1855 Becquerel secured the production of an electric current by the oxidation of carbon in melted potassium or sodium nitrate. He used a platinum crucible for one pole and filled it with melted potassium nitrate. The other pole was a carbon rod suspended in the nitrate. On heating the crucible the carbon took oxygen from the nitrate forming carbon dioxide and developing an electric current.

Jablochkoff improved this device by using instead of the expensive platinum any metal not attacked by the molten nitrate. He also used a hinged cover and collected the gases evolved for further use. Mixing metallic salts with the nitrate regulated the voltage and prevented the precipitation of metallic deposits on the negative element.

Riatti's thermal cell was simpler in principle. A tank was filled with saturated copper sulphate solution and kept saturated by a sack of the crystals. Two copper tubes passed through the solution, one near the top and the other near the bottom. A stream of cold water circulated through the lower tube and steam through the upper. The hot tube dissolved and the lower one received a deposit of copper while a very steady electric current was set up. This is one of the most interesting heat cells for it illustrates the cause of electro-motive force in any primary cell. Whenever two metals of different solution tension are placed in an acid or alkaline solution we have a primary cell and resulting current. This simply means that if one metal, say zinc, dissolves faster in the solution used than does the other, say platinum, a current will result. In Riatti's thermal cell the poles were made of the same metal, copper, but the hot one naturally dissolved faster than the cold one. It is important to note here that the solution was saturated, held all the copper sulphate it could, so when some copper dissolved from the hot pipe it had to deposit on the cold one.

Edison's heat cell consisted of a cast iron vessel closely fitting into a furnace and covered with a tight lid. In the lid were two openings—one through which a carbon rod was fed and the other through which air was drawn to produce a partial vacuum in the vessel. Of course the carbon rod was insulated by a porcelain ring. The charge in the iron vessel was an oxide of lead, iron or copper and was kept at the melting point by the heat of the furnace. The carbon took oxygen from the iron oxide forming free iron and carbon dioxide with the evolution of an electric current. This action proceeded faster when the gas was pumped out as fast as formed.

The most famous heat cell yet produced is that of Jacques. It was invented in 1896 and excited very great interest in both scientific and popular circles. In this cell an iron vessel (low carbon) was suspended in a furnace. At the bottom of the iron vessel was an inlet for the introduction of a blast of air. A rod of gas carbon was suspended in the iron pot by an insulating cover. The charge of sodium hydroxide in the pot was kept melted by the heat of the furnace—maintained at a temperature of 750° to 930° F. A blast of air blown through the molten caustic soda oxidized the red hot carbon forming carbon dioxide which to some extent combined with the caustic soda forming sodium carbonate. The rest of the carbon dioxide escaped through a hole in the cover. A considerable electric current was set up.

A battery of one hundred cells one and

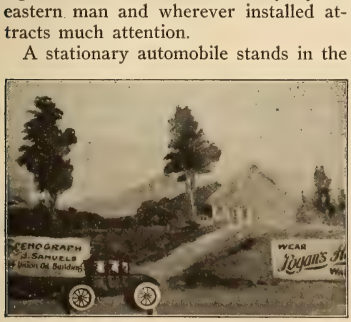
a half by twelve inches yielded a current of sixteen amperes at 90 volts for 19 hours. Thirty lamps of sixteen candle power were fed by them. Eight pounds of carbon were consumed so Jacques claimed an efficiency of 80 to 90 per cent of the total energy in the carbon. However he did not include in this estimate the expense of maintaining the furnace.

It is generally conceded now that all these cells merely converted heat into electricity and so missed the point of the ideal carbon consuming cell. In the perfect carbon cell the carbon must pass into solution in the form of ions, minute charged particles probably carrying four positive charges each and in this solution it must meet oxygen ions carrying probably two negative charges. They will discharge each other forming carbon dioxide and yielding nearly all the electric energy in the coal. In other words, as Ostwald says, the carbon and oxygen must form the opposite poles and act on each other through an intervening electrolyte. If they act directly on each other local action results with no current. So far no electrolyte has been found in which carbon ionizes. There is the problem of the future.—HARRY N. HOLMES.

Moving Panoramic Sign

An interesting mechanical advertising sign has been invented recently by an eastern man and wherever installed attracts much attention.

A stationary automobile stands in the foreground which is provided with movable wheels which turn continuously. The background consists of a display belt upon which pleasing landscapes are painted with here and there an advertising sign. The belt slides around on rollers giving the effect of the automobile speeding through the country.



MOVING PANORAMIC SIGN

In the construction of this device a housing is first erected and on the inside the display belt runs on two vertically placed rollers. An electric motor connects by a driving belt with the rollers. From the motor another driving belt connects with a shaft which runs two smaller belts and these operate the wheels of the automobile which revolve on their own axes.

The beauty of the landscape is the chief attraction of this display and original and interesting advertising signs are part of the plan of the inventor.

Measurement of Water Flow

Several terms are used—such as second-foot, miner's inch, and gallons per minute—to describe the quantity of water flowing in a stream, the one selected depending on the use to be made of the data.

According to the United States Geological Survey the "second-foot" is in most general use and from it the quanity expressed in other terms may be obtained. It is an abbreviation of cubic foot per second, and may be defined as the quantity of water flowing per second in a stream one foot wide and one foot deep at the rate of one foot per second. It is a *rate* of flow, and to obtain the actual quanity of water it is necessary to multiply it by the time.

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly as regards both time and area.

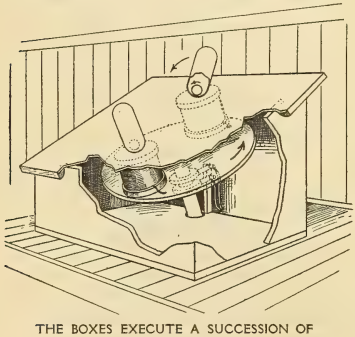
"Run-off, depth in inches on drainage area," is the depth to which the drainage

area would be covered if all the water flowing from it in a given period were conserved and uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is expressed in depth in inches.

The "miner's inch," the unit used in connection with placer mining, also expresses a rate of flow and is applied to water flowing through an orifice of a given size with a given head. The head and size of the orifice differ in different localities, thus making it a most indefinite and unsatisfactory unit. Owing to the confusion arising from its use, it has been defined by law in several States. The California miner's inch is in most common use in the United States and was defined by an act approved March 23, 1901, as follows: "The standard miner's inch of water shall be equivalent or equal to 1½ cubic feet of water per minute, measured through any aperture or orifice."

The Tumbler Boxes

A dealer in talking machines and phonograph records emphasized his advertising argument that his records were entertaining, by a show window display.



THE BOXES EXECUTE A SUCCESSION OF SOMERSAULTS

Two cylindrical record boxes were provided with round ends and placed upon a table, the top of which was inclined. Passers-by saw these boxes executing a succession of somersaults in a circle upon the table top. The peculiar action of the tumbler boxes is due to two electro-magnets made to rotate under the table top and to their attraction for a soft iron ball in each box.

Photo-Electric Cells

The thermopile and photo-electric or light cell have much in common. In the thermopile a bundle of wires or strips of different metals are joined at the ends and the two ends of the bundle kept at different temperatures. This maintains a difference of potential or electrical pressure between the two ends and a current may be obtained.

In the light cells two plates of metal or compounds immersed in a suitable solution are so arranged that one metal sheet is in darkness and the other exposed to light. A current flows from one pole to the other with a voltage depending somewhat on the substances used.

Becquerel, Grove and Sabine observed the effect of light falling on the platinum electrodes of a voltmeter, but Minchin was the first to make a real photo-electric cell. This was in 1880. His device was exceedingly simple. Two sheets of metal, possibly tinfoil, were separated by blotting paper and so placed that only one plate was illuminated. Minchin experimented with sunlight and the light from burning magnesium. By means of a delicate galvanometer in circuit he detected an appreciable current as a result of the unequal illumination.

Fleming's modification was a natural developement. Instead of using two flat plates, he made the cell of two concentric cylinders with the cylinder of blotting paper between. As in Minchin's cell the metal sheets were immersed in pure water. Of course the inner cylinder was in darkness and a difference in potential easily observed.

Kitching's cell, invented in 1882, was more complex. He used silver plates for the poles and could of course have de-

tected a current had they been placed in pure water and one plate illuminated strongly. But Kitching varied the plan somewhat by coating the silver plates with freshly made silver chloride and acidulating the water in the cell with a little hydrochloric acid. This proved to be a decided improvement, and when one plate received much more light than the other a current flowed from the light plate to the shaded one. In explanation it may be suggested that since light decomposes silver chloride—as in photography—a difference in concentration at the two poles results and the light cell then becomes a simple concentration cell setting up an electric current until the concentrations at the poles again become equal.

Sauer's photo-electric cell (1882) and others of its type and delicacy may prove of great value in weather observations. A porous cup containing a little mercury in which dips a platinum electrode is set inside a square glass vessel which contains a solution of 100 parts water, fifteen parts common salt and seven parts copper sulphate. An electrode of silver sulphide is hung in this outer glass jar. The whole contrivance is set in a box of wood or other opaque material with a door at the side. When the box is dark a slight current is noted, the platinum being the positive element. If now the side of the box is opened, the current increases in proportion to the intensity of the light. In fact it is abnormally sensitive to a very slight change in the intensity of light received. If in circuit with a galvanometer, an unrolling band of paper and a tracing pen it could record the variations in sunlight for an indefinite period. It is supposed that the copper sulphate acting upon the salt forms copper chloride, or cupric chloride, to be exact. This is then reduced to cuprous chloride by the mercury and finally this cuprous chloride acts upon the silver sulphide to form silver chloride. However, this last reaction does not occur without the aid of light, hence the sensitiveness of the cell to variation in light. Another light cell of value in measuring candle power is the Rigollet and Randall type. The poles are two copper oxide plates immersed in pure water. If one of these plates receives strong light while the other is in darkness a current of the order of millivolts is set up. The increase in electrical pressure is directly proportional to the light up to a certain point, hence it is possible to measure small candle power by this device. The electrical pressure is also proportional to the number of cells in series. A very interesting point in this connection is that coloring the copper oxide plates with various dyes, such as eosin, malachite green, naphtol yellow and other organic dyes, gives a notable increase in pressure or voltage. Very different effects are also observed if the cell is moved along the spectrum from red to violet light.

In all probability this suggests the real explanation of the action of all photo-electric cells. Ultra violet light whose waves are shorter and more rapid in vibration than the visible violet rays has a marked reducing action on many chemicals in solution. For example, nitrates are reduced, in water solution, to nitrites. Now oxidation or reduction at either pole in any solution will produce a current of electricity, so the reducing action of light in particular ultra violet light, exerted on one pole only will just as surely produce a current. Furthermore it has been found quite recently that some metals when immersed in water and exposed to strong ultra violet light, throw off minute charged particles in what is called the colloidal condition. This cannot be done without leaving an opposite and equal charge on the metal plates and a passage of electricity to the other pole not so exposed to the light results. Further investigation of metallic colloids may add considerable to our knowledge of photo-electric cells.—Harry. N. Holmes.

What is an Electrolier?

What is an electrolier? This question may sound simple inasmuch as it has been customary to call a chandelier for holding electric lamps as distinguished from a chandelier for holding gaslights, an "electrolier." Recently, however, various manufacturers of cut-glass electric portables, and even manufacturers of street lighting standards, have been calling their products "electroliers." Evidently, therefore, we must fall back on the general definition given in most dictionaries—that an electrolier is a support for electric lamps.—*Electrical Record.*

Flashing Election Returns

On the night of the recent national election, the Oregon Power Company, in conjunction with the Bell Telephone Company, transmitted election returns to every electrically lighted home in the city of Albany, Ore., by switching the lighting circuits on and off according to a system of flashes as follows: One dash (five seconds darkness) indicating Taft's election; two dashes (two intervals of darkness of five seconds each) indicating Wilson's election; three dashes (three intervals of darkness of five seconds each) indicating Roosevelt's election; four dashes indicating result as doubtful. The Bell Telephone received returns over its telegraph wires and transmitted them to the Oregon Power Company.

Electricity, Brandy and Champagne

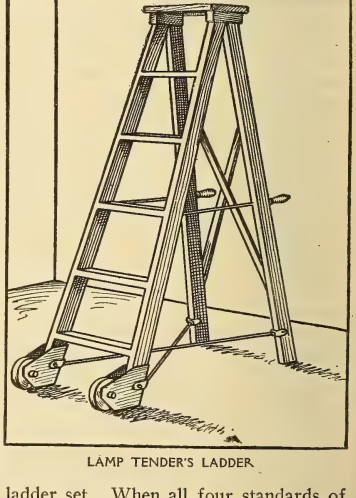
It is reported from abroad that, fanciful as the idea may appear, some success is attending the use of a wireless telegraph station to "age" and clarify wines.

It has been some years since chemists first conceived the notion of utilizing the action of electric currents of high frequency in the perfume industry. A kind of electrolysis, not yet fully explained, unites and compounds the diverse essences.

This phenomenon inspired some curious experiments in France. An electric generator of high frequency was installed in the storerooms, warehouses and wine vaults in order that Hertzian waves might be communicated to the spaces about the bottles. By this means, it is claimed, two widely differing results are to be expected—the aging of the cognac and the drawing out of the deposit which the fermentation process causes about the cork.

Ladder for Lamp Tending

Where a large number of incandescent lamps on the same floor and out of reach in fixtures are regularly cleaned it necessitates the lifting about of a step ladder. To transform a step ladder into an easily movable affair, wheels may be attached to metal shoes into which two legs of the



LAMP TENDER'S LADDER

ladder set. When all four standards of the ladder are on the floor it is firm. By raising the rear legs a trifle the whole structure can be pushed about on the wheels.

Electrical Securities

By "CONTANGO"

As suggested in the last issue of this magazine further mention will now be made of some of the large consolidated electrical undertakings which illustrate the points brought out in previous articles as to capitalization, bonded indebtedness, yield at the price at which you can purchase with other details briefly told. Such organizations present excellent opportunities for the investor's money and while the object is not specially to pass on the merits of the corporations named, yet the facts presented are set forth as worthy your consideration. Before investing your money in the securities of a company you will of course expect to inform yourself on the financial condition of that company—its capitalization, indebtedness, earnings, etc. To enable you to do this reliable companies issue at regular intervals financial statements. It will be well then to analyze quite carefully the few examples which follow so as to be able to judge of others that may come to your notice from time to time, as this is precisely the kind of information you should ask for and obtain in connection with any investment of similar nature which you may contemplate.

Pennsylvania Water, Light and Power Company

The Pennsylvania Water & Power Company is a Pennsylvania corporation, the development being located at Holtwood, Pa., on the Susquehanna River, about 20 miles from tidewater of Chesapeake Bay. The company has in operation about 73,000 horsepower, the ultimate capacity of the plant being estimated at about 120,000 horsepower.

The company owns a right of way 100 feet wide and 40 miles long from its plant to the City of Baltimore, carrying six aluminum transmission lines upon 400 steel towers, ranging in height from 58 to 120 feet; these towers also carry private telephone lines. There is also a handsome substation in Baltimore with a capacity of 65,000 horsepower, with space for the addition of 13,000 horsepower when needed. Power has been delivered in large quantities to the Consolidated Gas & Electric Light & Power Company and the United Railways & Electric Company of Baltimore.

The company's surplus earnings after paying the bond interest for the year ended December 31, 1911, were $66,-200. As this was the company's first year of operation, the above earnings may be considered satisfactory. The price of the bonds at the close of 1912 was 92 to 94, which means a yield considerably better than five per cent; the price of the stock at the end of the year ranged from 69 to 71.

United Light and Railways Company.

The United Light and Railways Company was organized in July, 1910, for the purpose of acquiring, financing and

Pennsylvania Water & Power Co. (Incorporated January, 1910, in Pennsylvania)

BONDED INDEBTEDNESS

	Authorized	Issued
Penna. Water & Power 1st Mtge. Sinking Fund Fives, J &. J.....	$12,500,000	*$7,930,000

Issued in $1,000 denominations; bonds may be registered as to principal and mature January 1, 1940. The Sinking Fund Provisions, for the purchase of bonds at not over 105, are 1915 to 1919 $50,000 per annum; 1920 to 1924, $75,000 per annum, thereafter $100,000 per annum.

CAPITALIZATION

	Authorized	Issued
Capital Stock (par 100).....	$8,500,000	$8,495,000

*Including $250,000 set aside to cover plant extensions during 1912.

operating public utility properties and has acquired and now owns directly, or through ownership of all or a very large majority of the stock, the following properties: Chattanooga Gas Company; Cedar Rapids Gas Light Company; Cedar Rapids and Marion City Railway Company; Ottumwa Gas Light, Heat and Power Company; Fort Dodge Light and Power Company; Citizens Railway and Light Company; Laporte Electric Company; Laporte Gas Light Company; Cadillac Gas Light Company; Grand Rapids, Grand Haven and Muskegon Railway Company, and the Tri-City Railway and Light Company. The last named company serves Davenport, Ia., Rock Island, Moline, East Moline, Ill., and adjoining towns including an interurban railway between Davenport and Muscatine, Ia.

The United Light and Railways Com-

CAPITALIZATION	Authorized	Outstanding
First Preferred Stock, 6% Cumulative	$12,500,000	$5,000,000
*Second Preferred Stock, 3% Cumulative	5,000,000	3,000,000
Common Stock	12,500,000	5,287,500
First and Refunding 5% Bonds	.....	4,375,000
One year 5% Note due June 10, 1913	.....	750,000

The first and second preferred stocks of the company pay quarterly dividends January, April, July and October.

*Of the outstanding $3,000,000 of second preferred stock, $775.000 is convertible at the option of the owner into either first preferred or common stock of the company, share for share, on October 1, 1913. The remaining $2,225,000 second preferred is convertible at the option of the owner into either first preferred or common stock of the company, share for share, on June 15, 1915.

The company has no floating debt, nor have any of the subsidiary companies. The United Light & Railways Company will advance to the underlying companies, as needed, the necessary funds for extensions and betterments to property.

The $750,000 one year note above mentioned was issued on account of purchase price of a recently acquired property and will be refunded before due date from the cash balances of the company or from the sale of additional preferred stock.

The company has a large amount of cash working capital.

ESTIMATED EARNINGS AND CAPITALIZATION STATEMENT

For 12 Months Ending	July 1, 1913	July 1, 1914	July 1, 1915	July 1, 1916
First Preferred Stock	$5,000,000	$6,775,000	$7,000,000	$7,000,000
Second Preferred Stock	3,000,000	2,225,000	2,225,000	2,225,000
Common Stock	5,287,500	5,537,500	5,537,500	5,537,500
United Light & Ry's Co. 1st 5's	5,750,000	6,250,000	6,750,000	7,250,000
Gross Earnings	$4,950,000	$5,425,000	$5,925,000	$6,425,000
Operating Expense, including taxes, maintenance, etc	2,895,000	3,165,000	3,445,000	3,705,000
Net Earnings	$2,055,000	$2,260,000	$2,480,000	$2,720,000
Interest and dividend charges of subsidiary companies	894,722	894,722	894,722	894,722
Balance	$1,160,278	$1,365,278	$1,585,278	$1,825,278
Interest on United Light & Railway Co's 5's	287,500	312,500	337,500	362,500
Balance	$872,778	$1,052,778	$1,247,778	$1,462,778
Interest on $750,000 1 year note	37,500	.....	.....	.....
Balance	$835,278	.....	.....	.....
Dividend 6% on 1st Preferred Stock	300,000	394,875	420,000	420,000
Balance	$535,278	$657,903	$827,778	$1,042,778
Dividend 3% on 2nd Perferred Stock	90,000	72,563	66,750	133,500–6%
Balance available for dividends on the common stock, depreciation, etc	$445,278	$585,340	$761,028	$909,278
Equal to	8.5%	10.5%	13.75%	16%

pany's operations as noted are conducted in the States of Iowa, Illinois, Indiana, Michigan and Tennessee, a large portion of them, however, being in the States of Illinois and Iowa. In all of this territory the franchise situation as a whole is stated to be good, the majority of the rights extending to 1929, 1930 and later dates and some are perpetual. The percentage of gross earning capacity of properties operating under shorter franchises than mentioned is less than thirteen per cent of the total.

Finally it may be mentioned the new money requirements are almost entirely for extensions and betterments necessitated by the rapid growth of the business.

At the close of 1912 the common stock was selling 77 to 80; the first preferred 84 to 86 and the second preferred 74 to 76 which means a yield on the first preferred of 6.97 per cent and on the second preferred of 3.94 per cent at the prices mentioned.

The table of estimated earnings just set forth shows that the estimated earnings for the first fiscal year's operations of the company under the present management were equal to four times the interest charges on United Light and Railways Company bonds—that the dividends on the first preferred stock after all prior charges should have been earned were nearly three times and that the dividends on the second preferred stock after all prior charges should have been earned were nearly six times, leaving the balance of more than eight per cent for the common stock on that basis of estimate.

Public Service Company of Northern Illinois.

The Public Service Company of Northern Illinois was organized under the laws of Illinois in 1911. It has acquired and now owns in fee all the properties formerly belonging to the following companies: North Shore Electric Company; Economy Light and Power Company; Chicago Suburban Light and Power Company; Illinois Valley Gas and Electric Company and the Kankakee Gas and Electric Company.

The company operates in thirteen counties in the northeastern part of the State of Illinois practically surrounding Chicago, serving a territory with a combined population approaching 500,000. The service rendered includes the supplying of electricity, gas, heating, domestic water and the operation of one street railway. The territory has grown rapidly and is likely to continue to grow equally rapidly.

CAPITALIZATION

Common Stock—	
Authorized	$15,000,000
Outstanding	9,062,500
Six Per Cent Cumulative Preferred Stock—	
Authorized	10,000,000
Outstanding as of Dec. 31, 1912	7,588,075

In considering the earning power of this company it is well to realize that in exchanging securities of the Public Service Company of Northern Illinois for those of the combined companies only $763,000 of the preferred stock was issued in exchange, the balance of the exchange of stock being in the common, and that the additional preferred stock issued for cash was to provide funds to pay for property acquired and the current needs of the company.

The amount of underlying bonds outstanding in the hands of the public has been reduced $2,012,500 in the period of ten months mentioned. At the close of 1912 the preferred stock sold from 99 to 99½ which being practically at par yields almost exactly six per cent. The five per cent bonds were quoted at the close of the year at 97 to 97½ which means a yield of little better than 5⅛ per cent.

These five per cent coupon bonds of the denomination of $1,000 dated October 1, 1911, and due October 1, 1956, are redeemable October 1, 1921, or on any interest payment date thereafter at 110 and interest.

EARNINGS

(As Officially Reported)

Ten months ending August 31st	1912	1911
Gross Earnings	$2,831,682.73	$2,567,067.68
Operating Expenses, including taxes	1,726,387.84	1,680,614.26
Net Earnings	$1,105,294.89	$ 886,453.42
Bond Interest	507,698.42	450,489.35
Balance	$ 597,596.47	$ 435,964.07

BONDED DEBT

Public Service Company First and Refunding 5's Issued	$8,734,000.00	
In Treasury	534,000.00	
Outstanding in the hands of the public		$8,200,000.00
Underlying bonds on portion of property (to retire which a sufficient amount of Public Service Company First and Refunding bonds are reserved with the Trustee) outstanding in the hands of the public		$5,916,500.00

SECURITY OF BONDS

These bonds are secured by a mortgage covering as a direct lien all fixed property now owned or hereafter acquired by the company. The mortgage is now a first lien on that portion of the company's properties formerly belonging to the Illinois Valley Gas & Electric Company, and to the Chicago Suburban Light & Power Company. These two properties produce about 30 per cent of the gross earnings of the combined properties acquired by the company. The bonds are further secured by the deposit with the trustee of $3,198,000 par value of underlying bonds as follows: $2,069,000 North Shore Electric Company first and refunding 5's; $222,000 North Shore Electric Company first mortgage 5's; $421,000 Economy Light & Power Company first mortgage 5's; $408,000 Kankakee Gas & Electric Company first and refunding 5's, and $78,000 Citizens' Gas Company first mortgage 5's. The first and refunding bonds, therefore, are not only a direct first lien on properties producing approximately 30 per cent of the total gross earnings of the company, but in addition share in the lien represented by the deposited bonds.

STANDARD GAS AND ELECTRIC COMPANY.

The Standard Gas and Electric Company was incorporated April 28, 1910, under the laws of the State of Delaware and controls companies located in Minnesota, North Dakota, Wisconsin, Illinois, Iowa, Arkansas, Alabama, Oklahoma, Colorado, Montana, Idaho, Washington, Oregon, California and Kentucky. The service consists of supplying gas, electric light and power, steam heat, telephone and street railway service. This company is controlled by H. M. Byllesby and Company, the well known public utility financing and operating engineers of Chicago, who in this case operate the subsidiary companies and who have a country-wide reputation in succesful operation of properties of this character.

As showing the amounts of bonds, preferred and common stock of the subsidiary companies taken over and absorbed in the issues of the holding company the table on the following page is interesting. It moreover gives a very good example of the methods pursued:

CAPITALIZATION

	Authorized	Outstanding
Preferred Stock, 8% (cumulative from June, 1912), Par $50. Dividends payable March 15th, June 15th, Sept. 15th and Dec. 15th.	$30,000,000	$10,977,950
Common Stock, Par $50	15,000,000	9,343,150

BONDS

	Authorized	Outstanding
In this case there is a funded debt of Convertible, Sinking Fund, Gold 6's	$30,000,000	$10,300,000

These bonds are dated December 1, 1911, and are due December 1, 1926. Subject to call at 105 and interest, but convertible at the option of the holders into preferred stock on the basis of $110 bonds for $100 of stock.

HOLDINGS

As of 1912	Bonds	Preferred Stock	Common Stock
Arkansas Valley Railway, Light & Power Co. 5s	$3,510,000	.....	$3,499,400
Consumers Power Co. (of Minn.) 5s	1,970,000	.....	.....
Enid Electric & Gas Co. 6s	20,000	$439,300	499,500
Everett Gas Co. 5s	915,000	124,200	628,400
Ft. Smith Light & Traction Co. 5s	150,000	798,700	949,900
Louisville Gas Co.	.....	.....	99,800
Mississippi Valley Gas & Elec. Co.	.....	1,000,000	1,248,500
Mobile Electric Co. 5s	241,000	277,500	864,200
Muskogee Gas & Electric Co. 5s	218,000	541,500	765,000
Northern Idaho & Montana Power Co. 6s	1,465,000	25,000	1,000,000
Northern States Power Co.	.....	498,200	759,500
Oklahoma Gas & Electric Co.	.....	1,294,300	1,150,000
Olympia Gas Co. 5s	70,000	.....	.....
Ottumwa Railway & Light Co. 5s	218,000	234,500	630,200
San Diego Cons. Gas & Electric Co.	.....	.....	2,715,000
Southwestern General Gas Co. 6s	528,000	25,000	1,000,000
Tacoma Gas Co. 5s	755,000	306,800	875,500
Tacoma Gas Light Co. 5s	683,000	.....	.....
Western States Gas & Electric Co.	.....	149,600	3,145,700
Sundry Notes	121,000	.....	.....
Totals	$10,864,000	$5,714,600	$19,830,600

At the close of 1912 the common stock sold from 22 to 23½ and the preferred at 50 to 51½, making the yield on the preferred 7.92 per cent or practically the guaranteed eight per cent.

The company's earnings in the first fiscal year presented were as follows:

STATEMENT OF EARNINGS

	Year ended June 30, 1912
Gross Earnings	$1,919,052.07
Expenses	37,698.96
Net Earnings	$1,881,353.11
Interest Charges	469,557.92
Available for Dividends	$1,411,795.19
Preferred Stock Dividends	684,894.72
Surplus	$ 726,900.47

By way of explanation it may be said that when a holding company finances through a bond issue, it is usually secured by the deposit of the securities of the subsidiary corporations or, in other words, the issue becomes a collateral trust mortgage. It is usually attempted to determine the amount of such bond issues by the value of the underlying properties as applicable to the securities actually obtained by the holding corporation which in turn bears direct relationship to the cost of acquiring these securities. Quite obviously such a process is largely a matter of appraisal.

Very often, however, preferred stocks will be the senior issue of the holding company and more than in the case of bonds, are inclined to bear relationship to the earning power of the properties acquired. These bonds, therefore, underlying or second in security, seldom represent new capitalization in the full sense of the word, because they are usually devoted to acquiring the securities of the subsidiary properties. Their further issue is to provide other tangible values acquired by the company, and the adequacy of these values determines the conservatism of the issue—the relation of tangible and physical assets to the mortgage. And finally the primary test of the financial success of any company is the stability of the underlying bond and preferred stock issues.

Cities Service Company.

This company controls, through ownership of their capital stocks, the Denver Gas and Electric Light Company, Spokane Gas and Fuel Company, Empire District Electric Company and the Brush Light and Power Company. It serves a growing population of about 450,000 with light, fuel, and power.

CAPITALIZATION

	Authorized	Outstanding
Preferred Stock (6% Cumulative)	$30,000,000	$10,195,360
Common Stock	20,000,000	5,499,430

STATEMENT OF EARNINGS

Gross earnings for 12 months ending September 30, 1912	$1,152,252.87
Expenses	82,596.86
Net Earnings	$1,069,656.01
Dividends on Preferred Stock	586,932.28
Balance for Common Stock	$482,723.73
Dividends on Common Stock	200,855.32
Surplus for 12 months	$281,868.41
Total Surplus to September 30, 1912	$503,797.11

Twelve months ending	Net Earnings.	Ratio of net earnings to dividends paid and accrued on average amount of Preferred Stock outstanding for the year.	Per cent earned on average amount of Common Stock outstanding for the year.
Mar. 29, 1912	$ 974,186.79	180.00	8.61
Apr. 30, 1912	990,780.26	180.30	8.69
May 31, 1912	1,007,640.06	180.60	8.75
June 30, 1912	1,023,436.52	180.86	8.81
July 31, 1912	1,040,137.51	181.19	8.89
Aug. 31, 1912	1,053,225.61	181.82	8.95
Sept. 30, 1912	1,069,656.01	182.25	9.03

Dividends are paid monthly at the rate of six per cent per annum on the preferred stock and four per cent per annum on the common stock. This company has paid dividends continuously since its organization in September, 1910, at the rate of six per cent on its preferred stock. On the common stock dividends were paid at the rate of three per cent per annum up to January 1, 1912, since which time the common stock dividend rate has been four per cent. In addition to paying these dividends the company has accumulated a surplus since its organization of $503,797.11.

It is the plan of the company to increase the dividends on the common stock one per cent each year until six per cent is reached, and thereafter to pay on that issue larger cash dividends and, in addition, to distribute annually to common stockholders a portion of the common stock of the company which is reserved for that purpose.

Cumulative Preferred Stock

This represents stock issued and sold to the public on which payment of a certain set rate of interest is assured. Thus it may be six, seven or eight per cent, as the case may be, and after the set dividend has been declared and paid the balance of the earnings may be applied to dividends on the common stock, or if there is a second preferred to the dividend on that.

The term "cumulative" is an additional guarantee, in that it means that if the set dividend or part of it remains unpaid in any year it has to be made up and paid in the next year, or in the first year in which the earnings are sufficient, and before any other dividend is paid, whether on second preferred or common stock or anything else. The preferred stock does not of course come before the bonded indebtedness if there be any, or of the sinking fund bonds forming a funded debt which may, as in the case of the Standard Gas and Electric Company, be convertible into preferred stock.

Bonds as an Investment

Public utility company bonds, as a type of investment, combine the highest degree of security with a constant and increasing earning power based on the fact that public utility companies furnish services which are absolutely necessary to any modern, civilized community.

Public utility concerns are not subject to the influence of bad financial conditions, but continue through periods of prosperity and depression to show, not only a constant earning power, but earnings increasing even in larger proportion than the increase in population.

The urban population of the United States is constantly increasing and each new inhabitant of a community means just that much more use of electricity, gas and transportation.

The introduction of public service commissions in the various states has also done much to place various corporations on a firm footing, inasmuch as under the public service commissions the corporations are not heckled by petty local politicians or forced to pay tribute to an organization under threat of competition.

The concentration and control of the various public utility companies throughout the country in the hands of strong holding companies is resulting in increased efficiency and economy. It is very certain that it will not be long before the bonds of most smaller public utility companies will be the underlying securities of large companies, as for example is the case with the companies treated of in the first part of this article. Thus the Kankakee Gas and Electric Company's bonds are now a constituent part of the securities of the Public Service Company of Northern Illinois.

While security and earning power rightly make the bonds of public utility companies grow in favor with the public, yet the yield as pointed out in the preceding pages by several striking illustrations has a great deal to do with it. Public utility bonds usually pay five per cent and are brought out as a general rule at a discount, that is, below par, so that the investor is able to secure returns from five to 5¾ and at the same time know that his money is conservatively invested.

Curious Uses of the X-ray

Many physicians, especially those of France, in the production by X-ray photography of an apparently solid image of such an object as a broken bone or a foreign substance embedded in the flesh, cause the tube producing the X-rays to oscillate by means of a cam revolving 300 times per minute.

Two radiographic images of the same object, as seen from different points, are thus formed on the viewing screen and by means of shutters electro-magnetically controlled by the oscillating apparatus. The right eye sees one image and the left eye the other, vision being cut off while the tube is changing its position. The result is that the image appears solid. In other words, the effect is stereoscopic.

Among the achievements of practical science is the development of a plant for radiographing pearl oysters to ascertain not only the existence but the stage of development of the pearls without killing the animals or opening their shells.

As many as 500 oysters have been submitted to examination in one minute, hundreds of shells spread on a tray being exposed at one time. Oysters showing no pearls are returned to their beds; those showing partially developed pearls are sent into "hospital" to be nursed, while those whose pearls are full grown suffer the fate that attends all things which possess something that man wants. It is said that radiography is not injurious to the oysters.

SCIENCE EXTRACTS FROM FOREIGN JOURNALS

Blast Firing with Wireless.—In the course of a paper read before a London meeting of the Association of Mining Electrical Engineers, Mr. E. Kilburn Scott referred to the future possibility of firing mine and quarry explosives by the wireless methods, thus securing greater safety for those who are carrying on such work. Shot firing is a risky business at the best, and the farther one can get from the explosion the better one is situated to avoid accident. The adoption of wireless methods for this kind of work would of course extend the possible range of the firing point almost indefinitely. The question is a most interesting one and it only remains to carry out the method in a practical way.—*The Marconigraph, London.*

White Light from the Mercury Lamp.—A German inventor has succeeded in getting a very good white light from a mercury vapor lamp, and should his experiments be upheld in practice this will mean a much wider use for lamps of this kind. Great results were expected from them at first on account of the cheapness of the light, but unfortunately the color of the light is very bad owing to the lack of the red rays. The inventor, Wolfke of Breslau, now finds that the metal cadmium is excellent for this kind of a lamp, when mixed with a small percentage of mercury, and as the cadmium melts at a low heat, he is able to produce a vapor lamp which glows with a brilliant white light. This shows up objects in their natural colors about as well as an arc light, so that the new lamp will be very good for use in stores where the natural colors and shades of goods need to be well shown up. Inventors have long been looking for a solution of this problem, as it is a most practical one from the fact that a really good lamp would be soon taken up by the public.—*Revue Electrique, Paris.*

The Speaking Incandescent Lamp.—After the speaking arc which awakened so much interest, we are now to have the speaking incandescent lamp, and this will be no less remarkable. In fact, it is found that a lamp can be made to act as a telephone receiver, and to do this we need to use a metallic filament such as an Osram lamp of 100 candle power. It is connected on a 120 volt, direct current circuit, with the use of a self-induction coil. In shunt on the lamp is a condenser and also the secondary winding of a telephone transformer. On the primary end of the transformer is a five cell storage battery and a microphone transmitter. Words spoken into the transmitter are reproduced by the lamp, thus giving a most novel effect. To explain this, we may suppose that the telephone currents are added upon the direct current so a to give waves which cause the lamp to burn more or less brightly according to the strength of the waves. This causes small changes of heat in the lamp which act on the glass and the air, so that a sound is heard. Thick glass stops the action, and it is best to use a 500 to 1,000 candle power lamp with thin glass, as this is most sensitive and gives the best sounds.—*Cosmos, Paris.*

Across the Alps by Electric Auto.—An enjoyable trip across the Alps in an electric automobile can be had as soon as the new Swiss scheme is organized, which will be before long. Electric auto-cars are to make the 25 mile trip between Airolo and Ulrichen over a very picturesque country in about two hours, not counting the stops. The road between these two points runs in the mountain region by way of Bedretto Valley and the Nufnen Pass. However, it will take a great deal of work to enlarge the roads and make them suitable for running the heavy automobiles, and a bridge will need to be built over the

Tessin River. The cost of the undertaking which includes roads and automobile plant will be about $500,000. It is proposed to make three trips a day each way and all the year round except when snow hinders the running of the cars.—*Revue Polytechnique, Geneva.*

Engaging Servants by Wireless.—The idea of engaging servants by wireless is a new one, but it was the latest expedient of the ladies in New Zealand. It seems that this serious domestic problem meets with as little solution in the antipodes as in the home country, but the brighter spirits among the mistresses of New Zealand have cut the Gordian knot of their own difficulties in a most ingenious way. News reached Wellington that the *"Turakina"* which was shortly to arrive from London, had on board between 20 and 30 girls willing to enter the domestic service. That was satisfactory as far as it went, but the demand was far ahead of such a small supply. When the vessel landed, a number of anxious matrons were waiting, but they were doomed to disappointment, for the majority of the girls had been booked long before the end of the trip. To their chagrin they learned that their more wide awake neighbors had sent Marconigrams to the ship.—*The Marconigraph, London.*

Introducing Sewing Machine Motors in Strasburg.—Current for running sewing machines is sold on a very satisfactory plan at Strasburg, Germany, at present. The subscriber uses a one-sixteenth horse power, three phase motor and pays about 60 cents a month to the company. At the end of five years he owns the motor and the wiring. He pays for the current itself at another rate this being about two cents per kilowatt-hour, and the motor rent on the ordinary plan without sale is six cents a month. Should this be not paid, the company shuts off the current. It is found that a sewing machine motor of this small size does not cost over two cents per day for current, and beside, the work is done one-third faster by the use of the motor, also a more regular result is obtained as to the quality of the work. Motors are mounted either upon the machine or underneath and one German firm is bringing out a new method for belt stretching by a simple device so as to slow the speed of the motor, doing this by a foot pedal. A brake on the flywheel also brings the machine to a stop very quickly.—*Elektr. Zeitschrift, Berlin.*

Electric Food.—We already referred to the remarkable experiments made in France by Prof. Bergonié in the way of treating the human body by high frequency currents. In this way he was able to add to the heat contained in the body, and this means that the person absorbs a certain amount of energy and therefore needs to take in less food in order to keep up the system. Since then he has been making experiments which are almost of a sensational character. Using the current, he proves conclusively that he can supply heat to the human body and this replaces the heat which would need to come by consuming food or in reality burning it in the human system. We will give an example in order to show what can be done. He took a man of five feet ten inches in height and in very run down condition, as he weighed only 110 pounds. Although eating a great deal of meat, he was quite feeble and could not walk 300 feet without needing aid. Naturally he was not able to work, and was also very sensitive to cold. After a series of treatments by the electric bath lasting for 40 minutes each and corresponding to quite an amount of heat absorbed each time, his weight increased and he now weighs 140 pounds. He eats less food and is able to walk for hours without fatigue, and Dr. Bergonié states that he is almost in usual health and in bright condition. This example speaks volumes and we may expect some surprising results in the future from the new method. It is no

longer to be doubted that electricity replaces food to quite an extent.—*Le-Matin, Paris (daily).*

"Duraluminum."—Seeing that aluminum is largely used in the electrical industries, it will be of interest to speak of the new metal known as "duraluminum" which is brought out by A. Wilm of Berlin. It contains 90 per cent of the pure metal and the rest of various other metals, the exact composition not being given at present, and it is claimed to be much superior to the usual metal. It is strong as well as hard and when used as electric wire for running on poles, it does not need to be handled with as much care to avoid breakage. A span of six miles of steel wire breaks by its own weight, and of aluminum four miles, but the new metal shows as high as 11 miles, so that it is even tougher than steel. Again, when used in 300 foot spans the new wire shows the least amount of sag. By a tempering process, metal pieces can be made quite hard and this will be another good point. It is not much attacked by acid and unlike aluminium it does not corrode in the air. Probably much of the breaking accidents from the pure metal are caused by internal corrosion of cables.—*Revue Electrique, Paris.*

Wireless in the Balkan War.—It is said that the Turkish wireless station at Smyrna was destroyed by the Italian battleship *Pisa* last spring, and a spectator states that as many as 200 shots were fired. Thus there is no wireless post on the coast in the hands of Turkey at the present time but the Turkish vessels are fitted with an old type of Marconi apparatus. Shortly before the outbreak of the war the government secured two portable German sets and at once dispatched them to the scene of war. On the other hand, the Balkan states provided themselves with a good number of portable stations of different makes. The wireless plants at Athens and Varna, which have the latest Marconi apparatus, are able to connect with each other, and their range extends over all the scenes of war. It is stated that these two land posts are of great importance for the co-operation of the land and naval forces, seeing that thirteen vessels of the Greek Navy have new types of wireless apparatus, and these are also mounted on Greek and Bulgarian merchant steamers. The posts on the vessels have a good range and can make connection with the land stations at Athens and Varna at any time.—*Electrical Review, London.*

Wave Motors.—Millions of horsepower are going to waste which the sea could furnish us if only some practical way of running a tidal plant could be found. The idea is in the air at present and there are several projects in hand which are likely to be taken up before long. One of these is brought out by Engineer Pein, of Hamburg, and he proposes to lay out two large basins on the sea coast in Schleswig-Holstein. Two tidal basins connected by a narrow space are used, and the water takes a swift flow between the basins on somewhat the same plan as has been used in old times, but this has never been used on a modern scale and for running as large a plant as the 5,000 horsepower one which he is now designing. Part of the work is already done by a one and one-half mile jetty in the sea connecting with Nordstrand island. The basins will have 2,500 and 1,600 acres surface and the height of the water fall between them is four or five feet, so that with a great volume of water it is possible to run a set of 500 horsepower turbines, ten in number, so as to have 5,000 horsepower. This is only a trial plant, and should it succeed, a much greater amount of power can be obtained in this way by using larger basins and in greater number, as the sea will give an unlimited amount of power.—*Revue Polytechnique,* Geneva.

Electro-Magnetic Velocity

Experiments by Blondot on the rate of propagation of an electro-magnetic disturbance along a wire showed, according to one series of tests, a velocity of 184,183 miles per second, and according to another series, in which the distance traversed was nearly twice as great, 185,177 miles per second. The velocity of light is about 186,300 miles per second.

Electricity from the Sea

At first glance there seems to be no connection between the breaking of sea waves and the electrical condition of the air. Recent investigations, however, show that the shattering of the waves and the scattering of the spray have the effect of imparting positive electricity to the atmosphere. Visitors to the seashore experience a stimulation from the ozone contained in the air, and the presence of this is ascribed to the electrifying action of the spray from the breaking waves.

NEW BOOKS

Questions and Answers On the National Electrical Code. By T. S. McLaughlin. New York: McGraw-Hill Book Company. 1912. 210 pages. Price, $1.00.

This is a key and index to the National Electrical Code and classifies and interprets the requirements of the Code in a way to make the information more easily accessible and more readily understood. It recognizes the Code as the established authority, and undertakes to explain its method, purpose and influence.

Motion Picture Work. By David S. Hulfish. Chicago: American School of Correspondence. 1912. 564 pages with 278 illustrations. Price, $4.00.

The motion picture field comprises two industries, the manufacturing and the exhibiting of film pictures. Both fields are covered in this volume. Drawings, diagrams and numerous photographs are used to present instruction and aid the text. The subject matter is presented in two parts: Part I, The Optical Lantern, Motion Head; Part II, Photography, Motography or Motion Photography, Motion Picture Theater, Electrical Principles.

Experimental Wireless Stations. By Philip E. Edelman. Minneapolis: Philip E. Edelman. 1912. 219 pages with 80 illustrations. Price, $2.00.

One of the main objects of the book is to provide a standard design for so-called amateur stations which will take the place of the many varieties of hit and miss apparatus constructed by experimenters. It is intended as a guide to a rational, worthwhile study of the art and only matter which directly contributes to the practical has been presented.

Electricity, Its History and Development. By William A. Durgin. Chicago: A. C. McClurg and Company. 1912. 171 pages with 57 illustrations. Price, $1.00.

This book is intended for the man who desires a fair understanding of present day electricity, but who finds the statements of textbooks and manuals more detailed than he needs and a bit too dry to hold his interest. It considers the main events in the development of electricity preserving at the same time the romance of the work of the pioneers, past and present.

Practical Mathematics. By Claude I. Palmer. New York: McGraw-Hill Company. 1912. 136 pages with 20 illustrations. Price, Part I, 75 cents; Part II, 75 cents.

These comprise two of a series of books which are the direct outgrowth of a course in practical mathematics given by the author during the past eight years in the evening classes of the Armour Institute of Technology, Chicago. The students in these classes have ranged in age up to 55 years and have been for the most part practical men who have come to realize the need of a knowledge of elementary mathematics.

On Polyphase Subjects

From the Land of the Sultan of Sulu

Jolo is the southernmost port of any size in the Philippine Islands. The old and perhaps most familiar name is Sulu (the scene of the play of the Sultan of Sulu is supposed to have been located at this place).

A garrison of two infantry companies is now located at Jolo. Major George A. Skinner of the Medical Corps, United States Army is attached to this garrison and as a subscriber to the magazine he writes an interesting letter concerning conditions there, and one which might be well considered by some of our American manufacturers. Some extracts from the letter follow.

"Through the advertising columns of your magazine I found an engine such as I have long wished, the 'Baby' gas engine of the Elgin Wheel and Engine Company. I have one of these with me, an Edison 40 ampere hour storage battery and a number of six volt tungsten lamps. So we have the only electric lighted house in the island of this group. My little outfit has attracted a great deal of attention and I presume others will put in similar or larger outfits. There is of course no development along this line yet, but undoubtedly there will be.

"The greatest need of the town is an ice machine and when there is sufficient interest in this and electricity I presume some enterprising citizens will construct a plant and combine the commodities.

"We have a moving picture show, rather two of them, and of course each of these has its own engine and produces its arc for the machine. So the people are getting interested in electricity. I also have my Ford car here, electric lighted, and it's better than a circus parade when I take it out as I do from time to time. It is the first one that most of the people have seen. When I leave it for a moment or so there is a crowded street, for the people come from every direction to look at the strange beast.

"I wish you might interest some manufacturer to send out literature of small portable ice machines. They would sell like hot cakes at a county fair. Such machines are made, I know, and recently I saw an extensive description of them in the *Sc. Am. Supplement* of June 15th, but unfortunately the article does not state where they are made or their price. I saw something about a German machine of this character that retailed for about $75.00 that would make 20 or 25 lbs. of ice per day. Such a machine, if it depended upon heat for its action, like the one described in the article referred to, would undoubtedly find a large sale among the residents both here and on the isolated plantations; also on the small and sailing vessels that do not carry ice machines. Of course, here the Government maintains an ice plant of considerable size, but it cannot make nearly enough ice to supply this place alone. So the great need is a small, simple, portable ice machine such as I have suggested.

"Maybe you can hustle up some battery maker to put out a small pocket light of the storage type. The little flash lamps are fine, but by the time we get the dry cells over here they are about half run down and the lamp is out of business too much. If I had a small storage battery to take the place of the dry cells, I could keep it loaded all the time and all ready

for business. But it has got to be good, and not spill its contents, and be fairly strong. There would be a big sale for this class of pocket light. One with a battery capacity of maybe two to four ampere-hours at two to four volts would give great results.

Possibilities of Trade With India

One of the subscribers to this magazine is Mr. J. K. Kripalani of the firm of Gidvani & Co., Ramkrishna Mills, West Katcha, Hyderabad Sind, India. This firm does a general engineering and contracting business acting also as agents for foreign manufacturers. In a recent letter he made some suggestions for the development of business relations between our country and his. Over there they are very favorably inclined toward American products of all kinds, and especially electrical goods; but it is difficult to get them. To quote from his letter:

"The field for general engineering being vast, as I told you, it is ready for exploitation by all business people. The first among those are the English manufacturers and they are reaping a good harvest, first because they are helped by their own English Government as all the Government contracts generally go to them; secondly, because the English manufacturers are nearer to India than others, the mails being only fifteen days and with other countries like America and Germany it takes a month. The goods arrive within a month of order from England while from America it takes three to four months.

Knowing well that time means money no attempt is even made to order in the United States or Germany for the most part. This is a very great handicap. If by any means your government causes direct mail services between your country and ours I am certain business would develop to an undreamt of degree. If this cannot be done then the only other alternative is to send floating museums of your products to our country and finally to establish such museums at all the principal places of our country under the direct superintendence of your consuls.

"These are only a few suggestions to develop real business between your country and ours, for which I am very anxious, for I feel that American machinery and other goods are just the articles most suited to our needs.

"Besides the American manufactures being very adaptable to our requirements we don't experience much difficulty in ordering a variation in designs in our articles, should we so desire them.

"I shall be very glad if my firm comes into more intimate contact with manufacturers on your side and if you could help it in any way I shall feel much obliged.

"The foremost thing will be for me to be in possession of complete literature on the subjects of each manufacturer. The price lists and the discount sheets must accompany the catalogues. Blocks for illustrating their wares and advertising them in our local papers should also be sent. Cable words for all possible enquirers must never be omitted and when possible samples should be sent without hesitation. If the articles are too bulky, small models if in stock may also accompany.

"I feel this you can do very well, by making a special mention of my firm in your magazine for some time you could bring me in touch with most of your manufacturers. Suggest to me some bold enterprising men who would take some risk and venture in sending a few of their articles for donation purposes. All articles in electrical engineering interest me."

Hotel Clerk—I found the "Not to be used except in case of fire" placard those college boys stole out of the corridor.

Manager—Where?

Clerk—They had nailed it over the coal-bin.

* * *

The artist and his young wife had just returned from their honeymoon, when a friend dropped in and found them laughing over something.

"What are you two laughing over?" said the visitor.

"O, it was jolly," said the wife. "My husband painted and I cooked, and then we both guessed what the things were meant for."

* * *

The other day a dairy company's complaint clerk was called to the telephone. "This is Mrs. Mixin," she said. "I want to know if your cows are contented?" "Wha-a-at?" asked the amazed clerk. She repeated her question. "I see that your rivals advertise that their cows are all contented," said she. "I will begin to take their milk unless I am assured that your cows are all happy." The clerk begged her to hold the 'phone a moment. Then he went away and gnawed a corner off his desk. When he got his voice under control he returned to the 'phone. "I've just been looking up the books, madam," said he, "and I am happy to say that we have not received a complaint from a single one of our cows."

* * *

Manager—Where is Jones?

Office Boy—He isn't in. His wife sent him word that the baby was asleep and he's gone home to see what it looks like.

* * *

A teacher gave her pupils an exercise to write on the blackboard.

In the midst of the exercise an urchin began to laugh. She asked him why he was laughing and he answered:

"Joe's put putten where he should have putten put."

* * *

Kid—"I want to ask you a question.

Sister's beau—"What is it?"

Kid—"When you were a little boy and fellers called on your sister did they ever give you a nickel to go out and play?"

The traveling salesman had four minutes in which to catch his train.

"Can't you go faster than this?" he asked the street car conductor.

"Yes," the bell ringer answered, "but I have to stay with my car."

* * *

"Oh, Willie! Willie!" cried a teacher to a hopelessly dull pupil, "whatever do you think your head is for?"

"Well," he replied at last, "to keep my collar on."

* * *

"Oh, mother, why are the men in the front rows baldheaded?"

"They bought their tickets from the scalper, my child."

* * *

"Waitah," said Colonel Clay, as he glanced around the dining room of the big hotel, "you all kin bring me a Kentucky breakfast."

"And what is that, sir?" asked the waiter.

"Bring me a big steak, a bulldog and a quart of bourbon whisky."

"But why do you order a bulldog?" asked the waiter.

"To eat the steak, suh," replied the colonel.

* * *

She—"If you could have only one wish, what would it be?"

He—"It would be that—that—Oh, if I only dared to tell you what it would be."

She—"Well, go on. Why do you suppose I brought up the wishing subject?"

* * *

Never ask leading questions when examining your pupils. Do not hint at the answers. Make the learner find them unassisted."

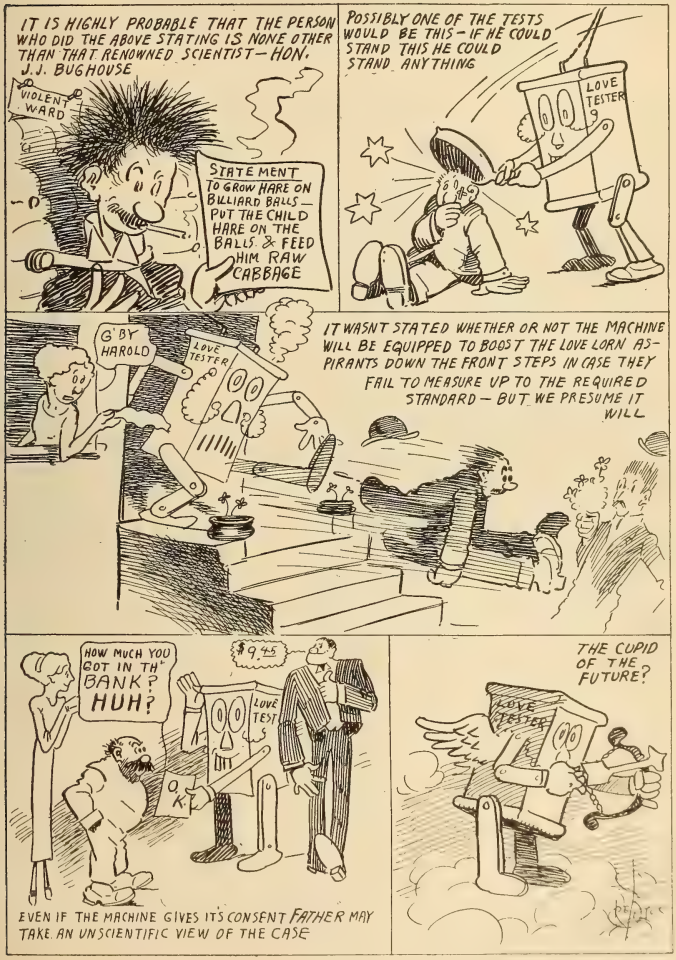
This is how the young lady teaching Greek history obeyed the rule.

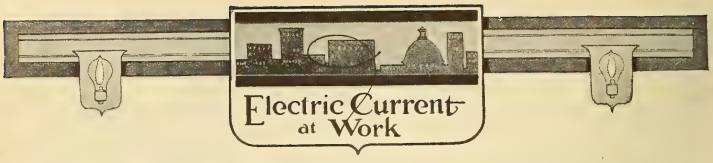
"Willie, who dragged whom how many times around the walls of what?"

* * *

A teacher in a lower grade was instructing her pupils in the use of a hyphen. Among the examples given by the children was the word bird-cage. "'That's right,' encouragingly remarked the teacher. 'Now, Paul, tell me why we put a hyphen in bird-cage?' 'It's for the bird to sit on,' was the startling rejoinder."

ACCORDING TO PRESS REPORTS MEN OF THE FUTURE WILL CHOOSE THEIR WIVES BY THE AID OF ELECTRICITY. WITH THE AID OF THE LOVE TESTER SWEETHEARTS WILL BE ABLE TO TELL WHETHER THEY ARE REALLY FITTED FOR ONE ANOTHER OR NOT

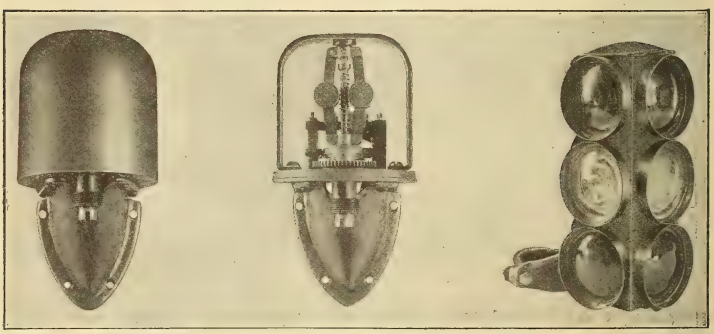




Warning to Motor Speeders

Motorists who exceed the speed laws are to advertise the fact for the benefit of public and police, if the voters of Los Angeles pass an ordinance for which initiative petitions are now being circulated. The proposed law will make it compulsory for all motor driven vehicles to carry an electrical speed indicating device, which is equipped with three lights placed one above the other. This triple lamp is set on the hood of the car or over the handle bars of a motor cycle and as the speed progresses, a variety of colored light combinations are shown. In this way, an observer can tell whether the vehicle approaching him at night is going at the legal speed or is breaking the regulations, and if so to what extent. The latter is an important point, for when a culprit is brought before the judge, he may escape with a fine if he is not going more than 30 miles an hour, while for speed above that he must receive a straight jail sentence.

The mechanism of the device is very clearly indicated in the series of photographs, the governor being connected with the speedometer shaft which as it whirls faster and faster, throws the current on the white the green and the red lamps and finally on combinations of the three, registering different speeds up to 60 miles an hour. Going ten to fifteen miles an hour a white light is flashed; from 15 to 20, a green light; from 20 to 25, a red light; from 25 to 30 a red and white, and so on. The lights show from in front and from both sides through a 2½ inch pane, while from the rear, visible from the chauffeur's seat, they show as little points of light. The rear lights thus serve to warn the driver if he inadvertantly exceeds the speed limits, which vary in different parts of town and in the country. Of course it is necessary to provide for a system of



CASING FOR THE GOVERNOR THE GOVERNING MECHANISM TRIPLE LAMP TO BE MOUNTED ON THE CAR HOOD

sealing and locking the case containing the mechanism and this should be done by a city official, who should also test the device at certain intervals to see that it is working properly. Any tampering with the seal or mechanism should be punishable by law.

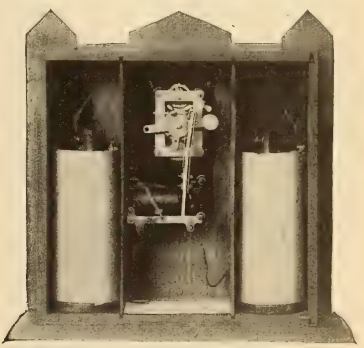
An Office Convenience

There is no more reason to-day for the use of the old fashioned stick of sealing wax and flame than there is for the wax candle or kerosene lamp. The electrical wax melter and dropper is one of the most useful productions in the line of office conveniences. The apparatus consists of a melting pot to hold the wax and this is attached to an electrical heating device that offers sufficient resistance when the current passes through to generate enough heat to melt the wax. The operator by the pressure of a finger can release the molten sealer in as small or as great quantities as may be expedient.

WAX MELTER AND DROPPER

Battery Wound Clock

A clock that needs attention not oftener than once a year and perhaps at longer periods is to be had in the self-winding clock which obtains its energy from electric current. In the picture the interior of the American clock of this type is shown with two dry cells to supply current. The clock is run by the action of a weight at the end of a lever arm attached to the clock mechanism. When gravity carries this weighted arm to a certain point in its downward travel, a contact is closed which allows the batteries to energize an electro-magnet. The armature of the magnet almost instantly raises the weight to its upper position ready to again turn the wheels. The weight is lifted practically once every minute. This frequent rewinding keeps the same pressure upon the clock train all the time, making it a good timekeeper. The batteries need renewing once a year.



THE "WORKS" OF A BATTERY WOUND CLOCK

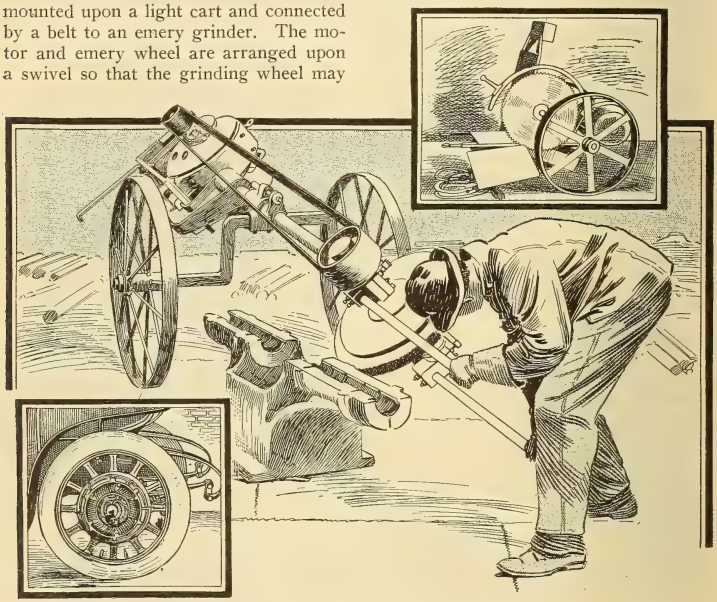
Taking the Motor to the Work

One of the most decided advantages of the electric motor is in being able to take it, with the machine it drives, to the work.

In the illustration a motor is shown mounted upon a light cart and connected by a belt to an emery grinder. The motor and emery wheel are arranged upon a swivel so that the grinding wheel may be played upon the work. A single workman can thus take care of castings that would require the services of several men to handle if they had to be carried to grinding machines.

An unusual application of placing the motor close to the work is found in some storage battery trucks in which the motor is built into the hub of the drive wheel as shown, thus doing away with the usual mechanical transmission.

The large number of bad spots in wooden block street pavement are due to poor fitting of the blocks, the shaping of these blocks being done with an ordinary hand hatchet. A portable circular saw operated by a motor now replaces the hatchet, with the result that saw fitted blocks make a more solid and lasting roadway.

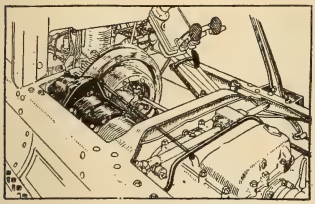


BRINGING THE MOTOR TO THE WORK

Automobile Electric Starter

Cranking up is labor that every automobilist would like to avoid. The Gray & Davis electric motor starter here illustrated will do this by simply pressing the foot upon a pedal. This motor, which is especially built for starting a gasoline engine, connects by gears with the engine flywheel and each time the motor is used it keeps turning until the engine picks up. The motor then automatically ceases to operate.

It has shown its strength on test by turning a six cylinder engine for an hour and a half. One feature of the equipment is the absence of any drag upon the engine after the motor has per-



AUTOMOBILE SELF-STARTER

formed its labor. Another feature is the absence of hand operated switches, the control of the starting operation being obtained by pedal action.

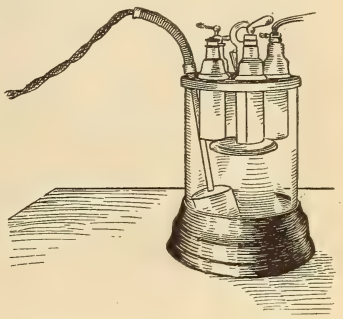
One of the greatest advantages of this system is safety. If the automobile should become stalled on a railroad crossing or in some traffic congested street, the motor may be applied to the engine and will propel the car until the engine picks up.

The motor is operated from a six volt battery, the same one that is used for ignition and according to investigations the average time during which it really takes current from the battery amounts to a total of not more than 24 hours a year.

Instrument Sterilizer

The progressive surgeon or dentist is alive to the advantage of creating a favorable impression upon his patient. Most people nowadays know more or less about germs and of the necessity of absolutely antiseptic conditions. Therefore, if the dentist or surgeon can sterilize his instruments in full view of the patient the latter is put in a better frame of mind.

The use of the Monarch sterilizer furnishes an example to illustrate this point. The instrument is a little metal affair composed of a cylindrical heating unit on a short handle. The wires from the lighting circuit pass down through the handle and connect with the resistance wires inside the heater. When current is turned on the latter is brought quickly to a high temperature. This device is plunged into the glass container for the

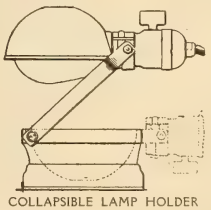


DENTISTS' INSTRUMENT STERILIZER

instruments right in front of the patient and he can see the water steam and even boil.

Collapsible Electric Light Holder and Stand

A lamp which the traveling man and tourist will appreciate has been patented by Jefferson F. Pierce, Tampa, Florida. It consists of an electric light bulb and

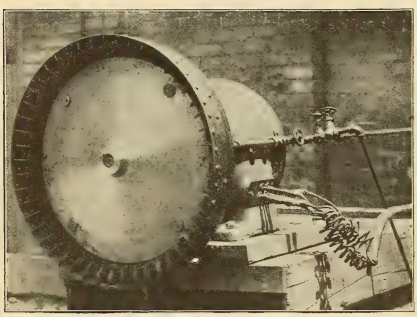


COLLAPSIBLE LAMP HOLDER

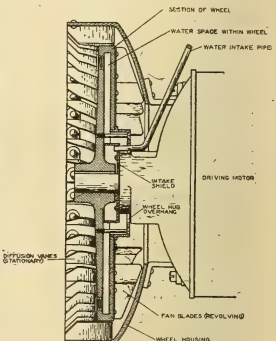
socket upon pivoted arms fastened to a concave base and so constructed that when collapsed the lamp, shade and arms nest within the base. The devise thus occupies little space in a trunk or traveling bag.

Air Humidifier for Mines

That miners may work with greater safety to life and health the United States Bureau of Mines at its Pittsburgh station recently tested a big motor driven air humidifier for throwing into the air myriads of tiny particles of water. It was designed by one of the engineers of the Bureau.



AIR HUMIDIFIER FOR MINES



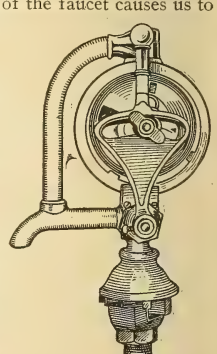
The humidifier consists of a hollow wheel mounted upon the shaft of an electric motor, the wheel being provided at its periphery with spray nozzles and at its hub with an opening for the admission of water, while on its back are arranged a series of fan blades.

It will be noted that the back and rim of the wheel are enclosed in a steel housing that serves as a casing for the fan and as a support for the air diffusing vanes as well as a shield for the revolving parts. When the wheel is rotated at normal speed by the electric motor and water is admitted under practically no pressure to the opening in the hub, the centrifugal force developed at the nozzles in the wheel's periphery gives to the water a hydraulic pressure of more than 200 pounds per square inch. This pressure drives the water through the nozzles in the form of a fine spray which is carried away by the blast of air from the fan blades on the back part of the wheel.

It is held that the diffusion vanes cause the air to be discharged in the form of a cylinder whose axis is coincident with the fan shaft and the mist produced is extremely fine. There is practically no dripping of solid water.

Heats Water as Used

A little electric water heater made so that it is a part of the faucet causes us to say, "What next?" For cold water, turn on the faucet; for hot water turn on the faucet, then turn the switch.

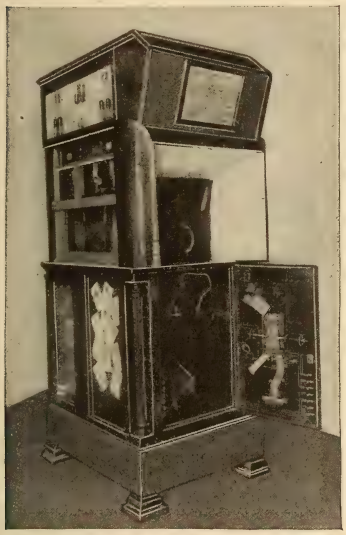


WATER HEATER

Upon the inside of the Sterling heater is a coil of wire in a porcelain cup through which the water flows. Electric current heats this wire which imparts its heat to the water. No more water is heated than is actually used and the heat shuts off with the water.

Coin Operated Photographing Machine

A recent French, coin operated, photographing machine is operated entirely by electricity, producing instead of the old tintype, a handsome portrait on a platino bromide postal card, so that it is likely to



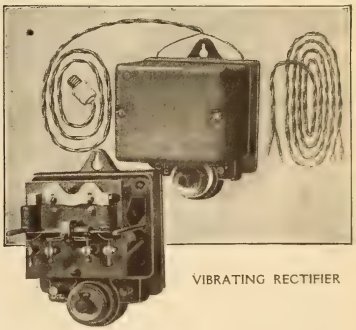
COIN OPERATED PHOTOGRAPHING MACHINE

prove a favorite with the public. The sitter drops in the coin and then a brilliant flash of light comes on so as to take a practically instantaneous portrait. The card is put through different chemical baths in a closed vessel or dish, each of the solutions being held in upper containing vessels and fed down by an electric valve which measures off the right amount in a small glass bulb and then feeds it into the dish. Water for washing the print is let into the dish in the same way, the dish being automatically filled and emptied by the electric valves. Then the card drops into an electric motor driven centrifugal dryer which dries it in fifteen seconds and it is then delivered to the sitter. A circular switch with an arm going around a contact disk is used to operate all the electric circuits in turn, the arm being driven by a small motor. The machine finishes the picture in 4½ minutes and is a marvel of ingenious work.

Vibrating Rectifier

For charging the small three cell storage batteries used for ignition and lighting purposes on automobiles a new type of alternating current rectifier has been developed by the Westinghouse company. It is not intended, however, to charge the large batteries for electric vehicles.

It operates on the vibrating principle not hitherto extensively employed for changing alternating to direct current. A technical description of the working of the apparatus is not possible here. It is sufficient to say that the device is very



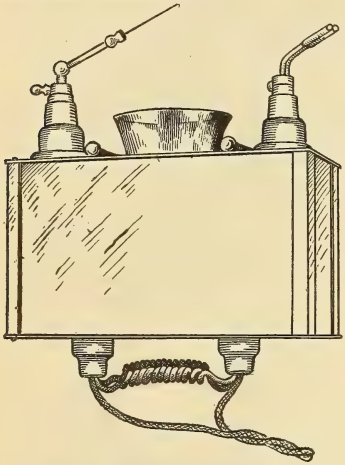
VIBRATING RECTIFIER

compact in size and to charge a battery all that is required is to connect the attachment plug to a lamp socket and the lower binding posts to the battery.

No care need be taken as to which pole of the battery is connected to which binding post, as it is immaterial. Should the supply circuit be interrupted temporarily the rectifier will start again as soon as power is restored to the line.

Spray Bottle Warmer

An example of one of the services that electricity performs for the dentist is illustrated in the accompanying picture of the Shoenberg spray bottle warmer. The



SPRAY BOTTLE WARMER FOR DENTISTS

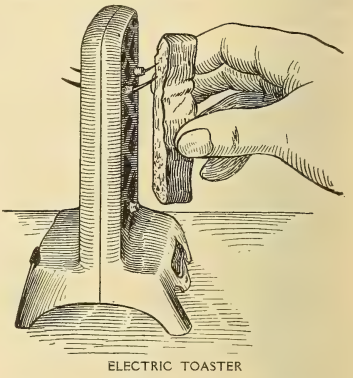
neat case encloses electric lamps which furnish the heat. Besides the two spray bottles there is room for a water glass.

Cord Adjuster

The accompanying illustration shows the Ideal cord adjuster which relieves the drop cord of wear. The adjusting cord is fastened to the socket and extends to the ceiling and is run through a slotted porcelain cleat. The end of the cord is weighted with an iron ball which is just heavy enough to keep the lamp and shade in place and in whatever position desired. The lamp can be pushed up or down with one hand without interfering with any work the operator is doing, and the lamp will stay in just that position. The adjusting cord is fastened to the socket by either a collar or a knot in the cord under the bushing.

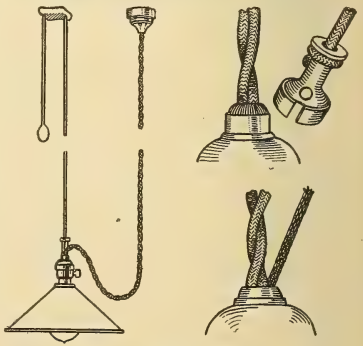
Hanging the Bread on the Toaster

There is a new electric toaster on the market, known as the Monarch, which embodies a very simple method for holding the bread in place. Four little pins



ELECTRIC TOASTER

or brads, two on each side of the upright frame, hold the slices in place. Two slices should be toasted at a time, as the heat is then more confined and the toasting done more evenly and quickly. The heating wires are mounted on suitable insulators inside the frame and glow red hot under the influence of the current.



ADJUSTER WHICH RELIEVES THE DROP CORD OF WEAR

POPULAR ELECTRICITY MAGAZINE

In Plain English

HENRY WALTER YOUNG, Editor

Vol. V | March, 1913 | No. 11

CONTENTS

	Page
New York's Grand Central Terminal	1137
Tantalum	1142
Electric Frost Prevention	1143
Novel Life Raft	1143
Building the Trolley in the Remote Places of the Earth	1144
Radium in Yellowstone Park	1148
Rivadavia—the Great Argentine Battleship	1149
Concrete Poles Molded in Sections	1150
An Electrical Fancy	1150
Dr. Infroit's Radiographic Laboratory	1151
Hornuth Lighthouse	1152
Economy of Electric Ware	1152
Illuminated Speed Indicator	1153
The Daughter of Heaven	1154
White and Black Coal	1159
Ratheneau Medal	1159
"Eating Electricity"	1160
Canadian Farmers Use Niagara Power	1161
Micrordiographs	1162
The Revealing Ray	1163
How the Swiss Exploit their Scenery	1165
Charles Bourseil—French Inventor of the Telephone	1168
Washing Cars by Electric Power	1169
Electric Motors in Track Switching	1169
Underground Transportation for Parcel Post	1170
The Elericity of Drops of Water	1171
A Telephone Credit Check System	1173
Street Lights Along the Curb	1173
In Recognition of Faithful Friends	1174
Piecing Out Daylight to Hasten Plant Growth	1175
Revealing Power of Light	1176
Searchlight Attachment for Pistol	1176
The Tree of Light	1177
An Electric-Sanitation Plant in Brazil	1177
The Sun as Light Meter	1178
Electricity Building at Panama-California Exposition	1180
The Diamond Electric Sign	1180
Electric Incubator and Brooder	1181
Lighting the Bastile Column	1182
Electric Advertising in Shanghai	1182
Troublemaker's Portable Searchlight	1183
Mount Wilson Observatory	1184
Money-in-the-Slot Restaurant	1185
Warm Meals for the Horse	1186
Automatic Compasses for Ships	1186
Economical Lighting in a Pumping Plant	1187
Thawing Frozen Water Pipes	1187
From Ingot to Wire	1188
Construction of the 1915 Exposition Begun	1194
Radiation from Potassium	1197
The Rotating Spiral	1197
Safe Opened with a Tuning Fork	1198
Telephone Extension Bell	1199
Measuring Temperature From a Distance	1199
Police Call System	1201
Diver's Outht Equipped with Telephone	1201
Public Entertaining Revolutionized	1202
"Talking Movies," Edison's Newest Invention	1204
High Tension Roof Wiring	1206
Why Tungsten Lamps Are Better than Carbon Ones	1207
Classes in Pulmotor Practice	1208
Suction Cup Fixture Holder	1209
Electric Drilling in the Oil Fields	1209
Electrical Men of the Times. Ernest Freeman	1210
Telephones in the Vatican	1212
Missouia's Lane of Light	1213

Electrical Interests of Women

A Lesson in Values	1214
The Permanent Hair Waver	1216
Captured Coffee	1218
Recipe Box Aid to the Housewife	1218
Clock That Needs No Winding	1219
A Versatile Small Motor	1220
Electricity as an Invigorator	1221
Thoughts for Housewives	1221

Junior Section

To Take Your Photograph	1222
The Power of a Meteor	1222
Aiming and Firing a Heavy Gun	1223
Strange Electric Storm	1223
An Archimedes Tower	1224
Odd Static Generator	1225
Short Circuits Produced by Birds	1225
And Their Friends Were Led to t	1226
Controlling Finger	1226
Fishing Up a Cable	1227
Handling a Carnival Crowd in Manila	1227

Popular Electricity Wireless Club

Experimental 200 Meter Wave Sets	1228
Receiving Stations on the Ground	1231
Nine New Wireless Stations for Canada	1232
Washington Greets Honolulu	1232
Increased Cost of Living in France	1233
The Universal Hour	1233

For Practical Electrical Workers

Telephone Wiring	1234
Fault Finder	1240
Why Shunt Motors Speed Up	1240
Office Bell	1241
Drying Telephone Cables	1241
Dining Table Outlets	1241
Hotel Clerk's Private Exchange Board	1242
How Brass for Fixtures is Made	1242
Combined Direct and Indirect Fixture	1243
Tobacco Jar Humidor	1243
The "Winking Willies"	1244
Barber Pole as a Lamp	1245
Double Appeal for Customers	1245
Advertising in Waste Space	1245

Miscellaneous

Electrical Securities	1246
List of Selected Bonds Showing Income Yield	1249
Buying Stocks and Bonds on the Installment Plan	1250
Unique Lamp Exhibit	1251
Science Extracts from Foreign Journals	1252
Keeping Tab on an Electric Wagon	1254
New Books	1254

Electric Current at Work

Photographing Microscopic Objects	1255
A Revolutionary Improvement in Plate Printing	1255
Emergency Extension Plug	1256
The Odograph	1257
Motor Driven Hack Saw	1258
Telephone Slug Holder	1258
Stethoscope to Detect "Valve Slap"	1259
Automatic Electric Generator for Country Homes	1259
The Bond Tester	1260
Electric Lantern	1260
Battery Switch	1260
Automobile Tire Pump	1261
Moving Pictures by Incandescent Lamp	1261
A New Electric Vapor Lamp	1262
Steam, Electricity and Coal	1262
Trolley Wire Frees Captive Balloon	1262
The International Candle	1262
Short Circuits	1263

RENEWALS When your subscription expires, you will find a renewal blank enclosed here. You should fill out and return with remittance at once to avoid missing a number. Positively no copies will be mailed on any subscription after same expires unless renewed, and we cannot agree to begin subscriptions with back numbers. The date on wrapper of your magazine shows issue with which your subscription ends. The extension on this date to period covered by renewal is sufficient receipt. If any other is desired it should be requested at time of renewal.

CHANGE OF ADDRESS Notify us promptly of any change in your address, giving both the old and new location. Since our mailing list for each issue closes the 5th of the preceding month (i. e., list for April closes March 5th), changes received after the 5th must necessarily take effect with issue for second month following. Postmaster as well as Publisher should always be notified of changes in order to forward mail sent to old address.

ISSUED MONTHLY BY POPULAR ELECTRICITY PUBLISHING CO., Commercial Bldg., Chicago, Ill.
YEARLY SUBSCRIPTION, $1.50; CANADIAN, $1.85; FOREIGN, $2.25; SINGLE COPY, 15 CENTS
No additional copies will be sent after expiration of subscription except upon renewal.
Entered as Second Class Matter April 14, 1908, at the Post Office at Chicago. Under Act of March 3, 1879.

Copyright, 1913, by Popular Electricity Publishing Co.

THE GRAND CENTRAL STATION NEW YORK AND ITS SURROUNDINGS—FROM THE ARCHITECT'S DRAWING

Popular Electricity Magazine In Plain English

VOL. V. MARCH, 1913 No. 11

New York's Grand Central Terminal

By FRANK PARKER STOCKBRIDGE

Why not call New York's new Grand Central terminal the "Electric Station?" There is everything to justify it. There is not another railroad terminal in the world, and the Grand Central is the very latest and finest of its kind, where electricity is put to so many uses. Electricity was but an infant in the old Grand Central station nine years ago. Since then it has grown into the giant that dominates everything, does everything. From snaking the heavy trains in and out to washing the dishes in the kitchen, electricity does it all. Gas has been eliminated entirely, even for the purposes of cooking. The current has been made to do many new and novel things in such an eminently practical way that the telling of them is worth while.

Electricity starts to work away down under the terminal, where a "sump" pump automatically removes such water as may collect below the sewer line.

The incoming and outgoing trains are drawn by electric locomotives. All the switches and signals are operated electrically, and the signals are lighted by the same current.

Announcement of the departure and arrival of trains is made at 30 different points through the new application of an old principle in electricity.

Drinking water for the terminal is purified by a jump spark.

Freight elevators, baggage trucks, fans, ventilators and the usual office equipment are all electric. So are the clocks.

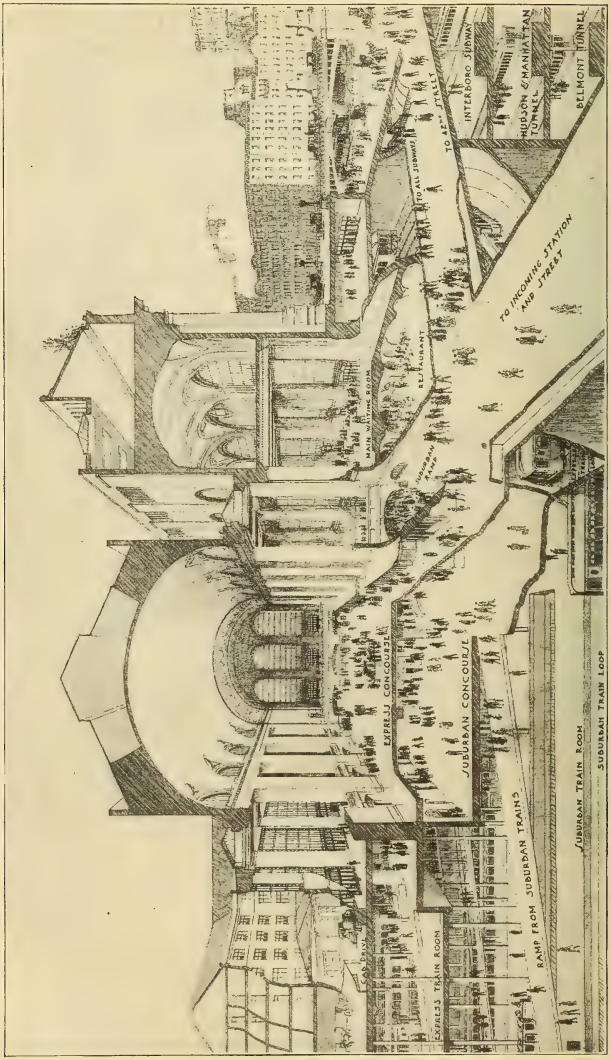
The electric current is used in copying blue prints and its helps to test concrete.

Incandescent and flaming arc lamps furnish the light.

An electric pump forces hot water through the radiators that heat the buildings. Cars standing on the tracks are heated by steam during the winter, but in case of emergency they can be heated by electricity as well.

During the better part of the year the current that does the many and manifold things about the terminal is generated at Port Morris, the main station. Current at 11,000 volts is carried from that point down to the substation at Fiftieth Street, where the alternating current is transformed by rotary converters to a direct current. A second method of obtaining power is by generating the current with steam driven turbines at Fiftieth Street. This is done during the cold months, when the exhaust from the turbines is used for heating purposes.

Probably the most interesting feature of the electrical equipment to the layman is the manner in which the departure and arrival of trains is announced throughout every part of the terminal reserved for the use of patrons of the road. Many



A SECTIONAL VIEW OF NEW YORK'S GRAND CENTRAL TERMINAL

of those who have followed the directions of the voice seemingly coming from the wall are under the impression that the contrivance is a combination of telephone and megaphone. It is neither, but something different from anything in use for the same purpose anywhere else in the world. The marvelous results obtained by the operation of the announcer are achieved through the new application of an old principle in electricity.

The announcer consists, first, of a mouthpiece similar in appearance to the ordinary telephone transmitter. But it differs vastly from the telephone transmitter in the important particular that it contains no induction coil. The transmitter also is unlike anything else of the kind in he fact that it is surrounded by a water jacket, through which a tiny stream of cold water flows constantly, cooling the carbon, which would otherwise become packed with the heat of the heavy current employed for operation. The transmitter is cooled in the same way in which the cylinders of an internal combustion engine are kept from heating.

This cooling of the carbon in the transmitter is made necessary by the fact that a current of 110 volts is used in operating the announcer. The ordinary telephone requires only a small fraction of this amount of voltage, and the current passing through it is correspondingly small. But it is through the employment of the heavy voltage that the remarkable results are obtained. The voltage is so equalized and the circuits so balanced on the Wheatstone principle that the sound of the human voice is intensified many times. And there is no limit to the number of points to which wires may be run for the transmission of sound from the central point.

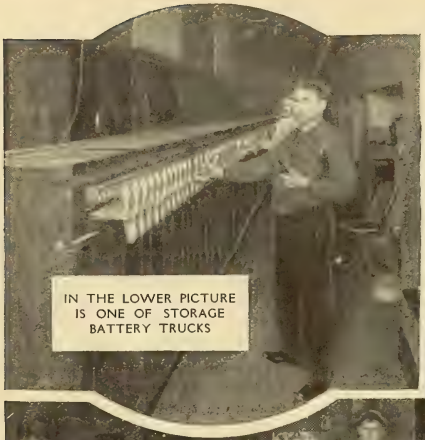
In the main waiting room of the terminal, in the smoking room, in the room reserved for women and on the concourses a series of horns, all resembling the phonograph horn, are in position against the walls. These horns are connected with the central station. When the operator is ready to announce the departure of trains he simply steps to the transmitter and speaks into it in an ordinary tone. Simultaneously there is heard throughout the terminal a giant voice telling all about the trains that are about to depart. Some 30 horns are in use at the present time and more will be added as necessity requires.

What is of almost equal interest is the manner in which the drinking water distributed through the terminal and offices of the company is purified. Not only is the water plant run by electricity, but every impurity in the water is killed absolutely by the employment of an electric spark. The layman would say, after seeing the plant in operation, that the water was so purified and vitalized by means of the electric spark that its properties as a life giving fluid were vastly enhanced.

The water purifying plant is situated on the fourth floor of the main office building. Ordinary city water enters through a main feed pipe and runs to a pressure tank. Thence it is forced through sixteen stone filters fastened to the rear wall. From these filters the water goes to the purifying outfit. The contractors who are erecting the terminal, and whose operation extend all over the country, say it is the first water purifying plant of its kind they have ever installed.

Actual purification of the water is accomplished when the current is turned on in a series of cells, somewhat longer and of about the same diameter of the ordinary dry battery. The cells are set up in batteries of twelve each and there are three such batteries in operation, the whole being enclosed in a wooden box with a door in front. Inside of each cell there are two electrodes, set far enough apart to produce a jump spark. Ten thousand volts are used to make the spark, though the amperage is very low.

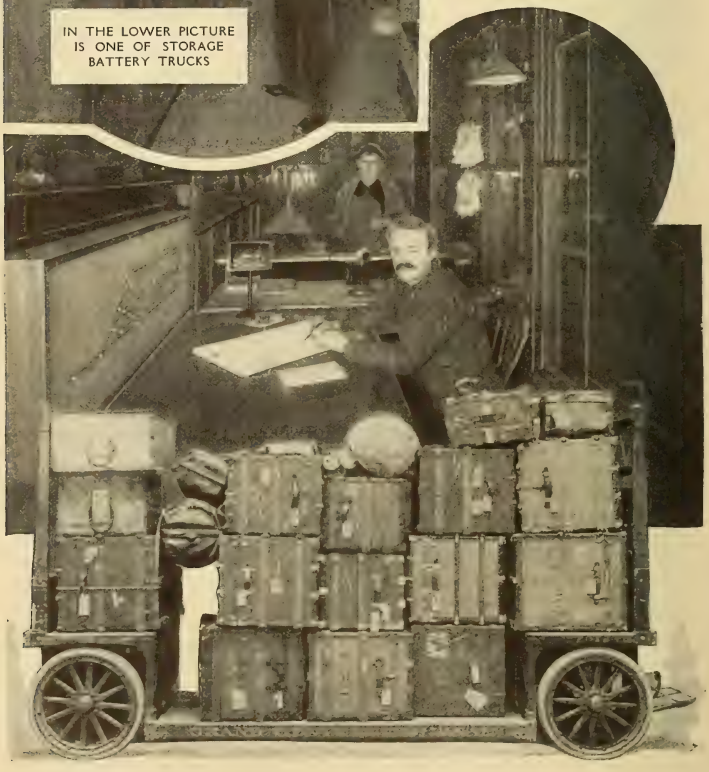
When the door of the box is opened the pungent odor of ozone assails the nostrils. It is this ozone, created by the



THE BRAIN OF THE ELECTRICAL INTERLOCKING SIGNAL SYSTEM. THE HUNDREDS OF SIGNALS ARE HERE CONTROLLED, EACH BY ITS INDIVIDUAL LEVER

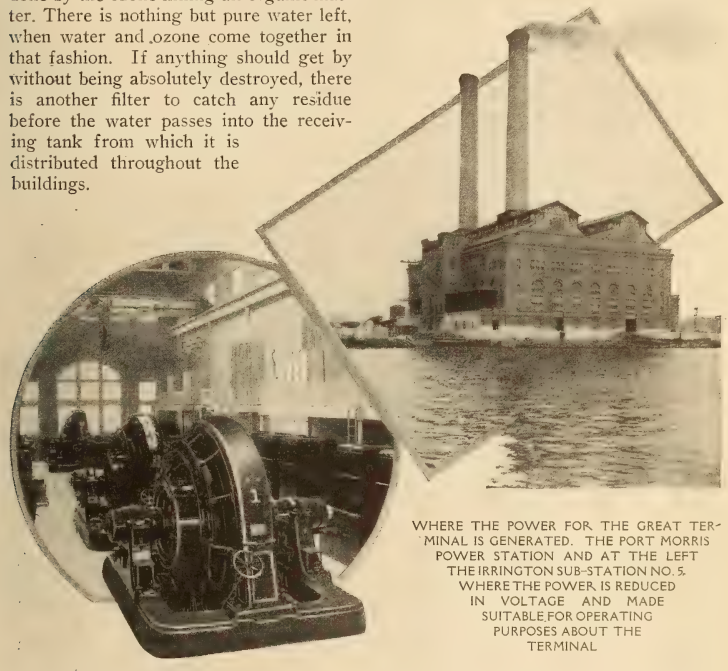
THE DIRECTOR OF SWITCHING AND SIGNAL TOWERS SITS IN AN OFFICE OF THE TERMINAL YARDS WITH A TRACK INDICATOR IN FRONT OF HIM

IN THE LOWER PICTURE IS ONE OF STORAGE BATTERY TRUCKS



spark, that does the trick of killing the impurities in the water. The box is connected with three injectors through which the water passes, and as the water rushes along enough ozone is drawn into it to accomplish the purification, which is done by the ozone killing all organic matter. There is nothing but pure water left, when water and ozone come together in that fashion. If anything should get by without being absolutely destroyed, there is another filter to catch any residue before the water passes into the receiving tank from which it is distributed throughout the buildings.

pulse is started which automatically throws a switch which starts up the machinery. When the supply gets beyond the normal the same switch shuts off the machinery. The pipes in the tank are covered with ice and frost. The



WHERE THE POWER FOR THE GREAT TERMINAL IS GENERATED. THE PORT MORRIS POWER STATION AND AT THE LEFT THE IRRINGTON SUB-STATION NO. 5, WHERE THE POWER IS REDUCED IN VOLTAGE AND MADE SUITABLE FOR OPERATING PURPOSES ABOUT THE TERMINAL

The tank to which the pure water finally finds its way looks for all the world like a huge icebox, which it is, in a sense. A 20 ton refrigerating outfit of the single expansion type completes the work of preparing the water for consumption. The refrigerator is run by a motor and the supply of water is regulated, as the whole plant is controlled, by electric devices that work automatically. If the supply of water gets below a normal point an electric impurified water, being forced through the buildings under pressure, passes through the tank many times.

But the novel uses of electricity in the new terminal do not end with the features already referred to. An odd trick was the substitution of storage batteries for the operation of electric bells and buzzers instead of employing the usual dry batteries. Dry batteries scattered about the offices were an eyesore to the officers of the company and so two large

storage batteries were installed on the fourth floor. The batteries are charged by two rotary converters. From these batteries also power is obtained to keep the clocks runing regularly and properly.

Electricity is even employed to test the concrete used in the construction work both in the terminal and all along the road. A "cement laboratory" is in operation in the main office building, where different combinations of cement and sand are tested before the proportions of each that shall be used for different purposes are decided on. A small motor is used to shake fine sieves through which cement is passed before being mixed with sand. The fineness of these may be judged from the fact that in some of the screens there are 10,000 holes to the square inch. For a man to stand and shake a screen like that would cost too much money. The little motor does the work economically and right.

In the same laboratory electricity is utilized to heat ovens in which the briquettes of sand and cement are baked or steamed. Both dry heat and steam heat are employed to prepare the briquettes for the pressure test to which they are subjected later. The current furnishes the heat that makes the steam.

Near the cement laboratory is located the blue print shop, where electricity is again the important factor in operation. Blue prints, of which there are many new ones every day, are copied on a slow moving roller of some eighteen inches diameter that is turned by an electric motor. The original blue print prepared by the architect is placed in the printing machine with a sheet of copying paper beneath it. The roller carries both close to arc lights of 1,000 candlepower each and the trick is done after the copy has been given a bath in a solution that fixes the lines on the prepared copy paper.

In the commissary department, where much of the cooking is done for the dining cars on through trains, electricity is employed exclusively. There are electric ovens where meats and fowls are roasted, electric ranges on which many things are cooked. The humble griddles are heated in the same way and finally ice cream is frozen in great electric refrigerators. An electric dish washer cleans the crockery and kitchen utensils.

The baggage trucks used in the terminal carry two tons each and are driven by storage batteries of twelve cells each, making 24 volts to each cell. They scoot around with big piles of baggage, doing swiftly and quietly what many men would be required to do in a much longer interval of time.

Truly, the new Grand Central terminal, when it is finally completed a year hence, might well be termed the "electric station."

Tantalum

Tantalum, that curious substance of which more or less use is made in the construction of filaments for electric lamps, is pure white and as hard as the best steel. When hot, it can be rolled, hammered and drawn out into wire. Its tensile strength exceeds that of steel. For lamp filaments it is drawn into wire hardly more than one five-hundredth of an inch in diameter. Its electrical resistance is much less than that of carbon, so that the filaments have to be much longer than the ordinary carbon filaments when they are used with the usual 110 volt lamps.

Tantalum melts at 2,300° C. Tungsten melts at 3,030° C. Like tantalum, it has a much lower resistance than does carbon.

In connection with tantalum deposits, there is reported the finding of a new mineral in the gold washings of the Ural Mountains. Analysis shows that it consists of 98.5 per cent tantalum, 1.5 per cent niobium, and .001 per cent manganese. It may therefore be regarded as consisting practically of native tantalum. The mineral occurs in very minute quantities, and is apparently an isolated formation.

Electric Frost Prevention

An electric heater for the protection of orange groves from frost is being tried out in the groves about Riverside, California, this winter

The device is being used on a small scale to cover sixteen trees in the belt which was affected by frost last year. Overhead wires have been strung above the trees and connections made with the heaters. The current will be turned on when required and careful observations made with thermometers to test the difference in temperature. Of course it is understood that in frost prevention it is not the rise in temperature alone that makes the difference, but the circulation or agitation of the air which a comparatively slight inequality of temperature can cause. It is stated that the value of this device promises to be so great that free current has been provided for the experiment by the Board of Public Utilities.

Another way in which electricity helps the orange grower is by the use of a complete telephone system around the Pomona, California, citrus groves. This telephone connects the homes of the growers with numerous stations among the orange groves which are visited at frequent intervals during the winter nights by a motorcycle rider who observes the thermometers at various points and promptly telephones the owner's house when any particular area is threatened by frost. By the use of the motorcycle patrol and the telephone, it is possible for the orange growers to receive a warning in time to start the smudges, or pots of burning oil under the trees, and thus prevent the great damage that a single freezing night could do.

Novel Life Raft

The picture indicates the construction of a form of an individual lifeboat or life raft and its method of operation. It is equipped with an electric light as noted in the rear and a compass in front. It was devised by Philipp Lentz of Berlin-Lichterfelde and measures 1½ meters in length. It is so designed that the user may have free use of his arms and legs for propelling the apparatus and can readily steer the craft by the aid of the compass.

AN INDIVIDUAL LIFEBOAT OR RAFT WITH ELECTRIC BEACON

He is fastened to the device by a single strap over his back which he can easily reach. The intermittent electric light is intended to aid in his rescue by showing the location of the apparatus in the dark.

The signal electric light consists of a ten candlepower tungsten lamp operated by a storage battery. A small electric motor is provided which automatically switches the electric light into circuit for two seconds with a pause of four seconds between the flashes.

Building the Trolley in the

You know that Oolong tea comes from Formosa. But do you know that there are 400 miles of electric railways in operation and under construction throughout the island? Do you know that primitive Formosa through the invasion of the trolley has become up to date, bustling, commercial? Let us see how the change came about:

The smoke was still drifting from Japanese guns; China was still groaning from its ill-fated war, when the little men of Nippon turned their faces toward Formosa. They knew the island was rich. They knew that these riches could not be obtained until the head-hunters had been driven away. So the Japanese landed their brown faced soldiers and drove the native bandits back into the mountains. Also, being able to shoot very straight they kept them there. The first obstacle out of the way, the Japanese conceived the idea of laying a system of electric railways over the island. So they began to build, using Keelung, the capital, as a center and tapping the remote corners of Formosa. The plan was to establish an electric service between the great sugar and camphor districts, the rapidly growing bamboo pulp factories and the natural outlet for commerce.

For a while the Japanese had a hard time building their line. No sooner had they raised trolley poles and put cars in operation than the head-hunters sneaked down. By night they came, excited with the plan of an old chief. A renegade Englishman had given it to him. And the plan was to cripple traffic by cutting down the poles. As the story goes the savages cut the poles but with them brought down a "live wire." Now even a savage's skin isn't tough enough to stand a "live wire." And after the chief had seen ten of the strongest warriors fall to the ground electrocuted, he concluded that it would

IN JAPAN THE TROLLEY BUMPS THROUGH THE MOST IMPORTANT CITIES

be a good thing not to cut down any more trolley poles.

And in a similar manner the trolley has sought the remote places of the earth, so let us follow the story more or less geographically.

Unlike Formosa the impetus for the trolley in Hawaii came from the West. In the Island Beautiful, Formosa, the Japanese were the builders. In Hawaii they were Americans. To-day Honolulu has a very up-to-date electric system. One of

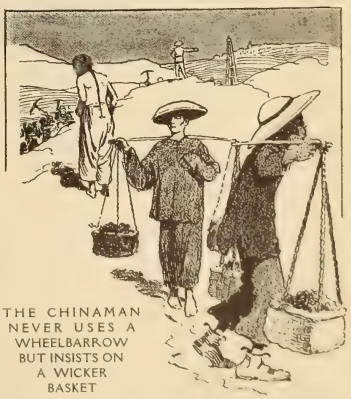
Remote Places of the Earth

its branches winds out of the town curving and climbing until it reaches the crest of the Punch Bowl, 500 feet above the sea. Not only is it popular with tourists but the residents favor it as well; and by residents I mean the natives as well as the foreign born. For the natives are very easy going, indolent, dreamy. They hail such effortless transportation as the trolley car as a gift from the God of the volcano Kileiu.

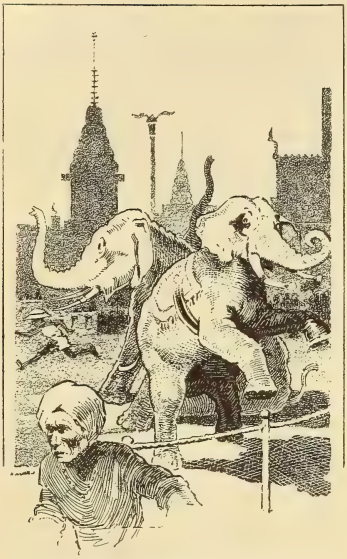
In the Philippines the story of the trolley is the story of a hard construction fight. As soon as Spain had been defeated an American engineering company sent its forces to the islands and built the Manila Electric Railroad. They found things very unsettled. The Philippines, more backward than Cuba, were stagnant so far as modern engineering went. An old system had to be torn down. Not only did the indifference of the people have to be overcome but certain climatic conditions presented serious obstacles. No sooner had the engineers begun work than they found that heavy dampness corroded the rails. Overcoming this by generous coatings of asphaltum paint they faced another difficulty. White ants were destroying the wooden ties. So the ants' party was spoiled by covering the rails with jodelite. That took away their appetite. Then it was found that the familiar tubular steel trolley poles were rapidly rusted in the Philippine air. Poles of native wood had to be substituted.

Then, shut out from the ties, the ants began eating the cars. So ordinary wood was dispensed with. Expensive teak had to be employed. And worst of all, the construction and excavating was done by the natives, whose habits make it necessary for the man employing them to watch closely.

No sooner had the Manila Electric Railroad begun to pay wages than the natives disappeared. As soon as they had a little money they quit their jobs and gambled. Those who remained used the luncheon hour to get into games. Their earnings paid for excitement instead of food. So the builders stationed lunchmen along the line, sold excellent and very tempting food at low prices—and won. To-day the Manila Electric Railroad has about 40 miles of track. Some of it runs through the suburbs, which means through a jungle. Here malaria and snakes lie on either side of the rails. Re-



THE CHINAMAN NEVER USES A WHEELBARROW BUT INSISTS ON A WICKER BASKET



FEARED THAT THE NOISE OF THE MOTORS MIGHT DISTURB THE CALM OF THE SACRED ELEPHANTS

pair work is costly. Yet since 1905 the line has been running continuously and at a profit. The native admires it chiefly for one thing—it enables him to reach the race track near Manila quickly.

Of course you would expect well equipped lines in progressive Australia. There are excellent systems at Melbourne, Perth and Kalgoorlie. Indeed the trolley has ever penetrated far-off Auckland. New Zealanders are as familiar with it as New Yorkers. This sounds stranger if you take a map of the world and see where Auckland is—one might call it the edge of the earth over which the doubters believed Columbus would fall.

But going up the Pacific we again meet the Japanese, the same busy trolley promoters who turned Formosa from a paradise of head-hunters into a paradise of money chasers.

In Japan the electric trolley hums through most of the important cities. It has forced the "ricksha" from the more traveled highways. It has robbed the native atmosphere of ancient charm and local color. Still it has facilitated transportation, helped bring the Empire up to date; helped the Japanese to make money faster, which is his second ambition. The first, as you know, is to make his empire the greatest of the world.

By way of emphasizing her up-to-dateness, her desire to hold her own in an age of mechanical progress, Japan has built an electric railway in Dalmy, that seaport of southern Manchuria torn from the grip of the Russian bear. Before Japan brought the trolley, Dalmy lived in another century. But Japan is no respecter of another country's traditions. For ages Corea, hermit of the Asiatic, resisted every innovation from the western world. Then flushed with her victory over Russia, Japan pushed some of the innovations down the throat of the ancient nation. To-day Corea has a trolley, running out of Chemulpo. It is planned to extend the tracks 25 miles inland to the ancient capital of Seoul. Of course, this is being done very much against the will of Corea. But what is the will of a dead kingdom? Still one cannot help wondering what the natives think of electricity, of the unseen force that speeds rattling cars over the dusty roads where once only shuffling coolies and lazy ponies toiled.

Even China has surrendered to electricity. Many of her large seaports are now networks of trolley track. Not so long ago conservative Hankow agreed to spend $20,000,000 on new and electrified transportation. Lines are being built everywhere. Still the natives persist in using the most primitive implements in carrying on the work. Often a trolley line in China must cross shaky ground, rice paddies, marshes. Piling must be done. Still you rarely see a modern pile driver in China. What you do see is a

yellow faced coolie setting the pile into position, gripping it with big bamboo poles and strapping these poles together. Then other coolies, chattering excitedly, cling to the outstretched bamboo and by sheer weight force the pile into the mud. Then they hammer aided by a big stone, held firmly between two timbers. Also in carting away dirt the Chinaman never uses a wheelbarrow. He insists upon his inefficient wicker basket. Another difficulty that trolley constructors had to fight in China is superstition. I mean a particular superstition. It is called "Feng-Shui." Now that is Chinese for what might be translated into "the symmetry of local topography." That is to say the Chinaman believes that the earth depends upon a balance. If he imagines a particular locality is not balanced properly he builds pagodas to establish the proper poise. And if he thinks the ground is balanced properly he is careful to place his house in such a position so as not to destroy the balance. Also he observes it in burying his dead so that they

THE ROYAL HEAD OF THE LAND ORDERED THAT THE POLICE WEAR TROUSERS

HINDUS USING GRUBBING HOES AND CARRYING THE DIRT AWAY IN BOWLS

may enjoy repose without the earth teetering and bothering them. It isn't good for a foreigner to ignore that superstition.

Once a party of American engineers plotted the survey of their trolley in such a way that it threatened the local "Feng-Shui." The American gunboat that came to their rescue arrived just in time.

The trolley has even invaded the Malay peninsula. Here the chief difficulty is in furnishing accommodations for the various classes. Of course caste rules in the Orient. The lower class natives have welcomed the trolley lines. Still they have yet to adjust themselves to new habits which the new transportation demands. When a native travels he invariably carries excess baggage. A farmer bears heavily laden baskets or balances vegetables, poultry and pigs from a long bamboo pole. Of course the natives insist upon carrying all their truck into the trolley cars—which is embarassing.

Siam was one of the first of the eastern countries to encourage the trolley. About eight years ago some American high in the favor of the White Elephant obtained a concession for a trolley line in Bankok. Previously bullock carts furnished transportation for those who did not

walk or ride in the boats of the muddy Meinam and its canal like tributaries. It was some time before the Americans dared begin work. The natives feared that the noise of the motors might disturb the calm of the sacred elephants. These objections overcome, the road was built.

Even then it innocently caused trouble. Up to that time the native police had dressed very simply. They wore a cloth around their waist, a hat and a smile. This wasn't considered in keeping with an electric railroad. So the royal head of the land ordered that the police wear trousers. The trousers came, were put on and so amused the people that great crowds gathered, blocking traffic on the electric line and causing unheard of excitement. The next day the trousers were removed and the police and the electric cars moved freely.

It would be easy to go on and tell how the motor invaded Bombay, how they dug 44 miles of track with Hindus using grubbing hoes and carrying away the dirt in bowls. It would be interesting to know how ancient Bagdad is building its electric line; how a trolley now runs from Cairo to the ruins of Heliopolis with the gray pyramids looking on; how they no longer close the gates at sundown in the Holy City of Jerusalem; how a trolley line is going where only camels and donkeys went before. To some the clanging of a gong, the whirr of the motor near those sacred walls may be a desecration. But the trolley has become a part of the Holy Land. Pilgrims are now using its cars to explore the streets of the Holy City. Modernity has pushed out the traditional archaism of Jerusalem.

The trolley has gone through South Africa from Cape Town to Camps Bay, and they broke the road through heavy rock, laid their tracks 800 feet above the sea and provided a wonderful view of Table Bay. The black natives became enamored of it, sold anything to get the necessary fare for a ride in one of the wonderful cars.

There is the story of Durban in Natal. Here they have an electric line owned by the municipality—a line that conducts a street car parcels delivery, carrying small packages at a very moderate rate. We have, therefore, something to learn from Durban.

And there is the tale of a thousand miles of trolley track in remote parts of Russia. Down in the small town of the Baltic provinces it has provided transportation for the poor. Farther north it has brought the people of the wheat districts closer one to the other.

You would think that the limit had been reached but you don't know the persistence of electricity. For centuries old Popocatepetl has lifted its peak two miles into the heavens. The Mexicans are proud of it. Its summit is far above the snow line. But soon an English syndicate will lay the tracks of a trolley up its slopes, climb them as easily as the trolley climbed Vesuvius, bring to the volcano top what it has never felt before —the mighty pulsing of electricity high above the snows.

So far has the trolley spread—penetrated the remote places.

Radium in Yellowstone Park

Recent investigations at the Yellowstone Park hot springs show that the travertin of the ancient terraces contains little radium as compared with that found in the terraces of later formation. The reason is thought to lie in the fact that the hot water has separated the radium from the uranium in the rocks and deposited it in the terraces where it gradually decays and disappears when not replaced by fresh supplies from beneath.

Certain of the travertin terraces are overlain by glacial boulders and it is thought that this fact affords a means of estimating the date of the last glacial invasion of the region of the Yellowstone Park. Assuming a uniform action of the springs, they make this date 20,000 years ago.

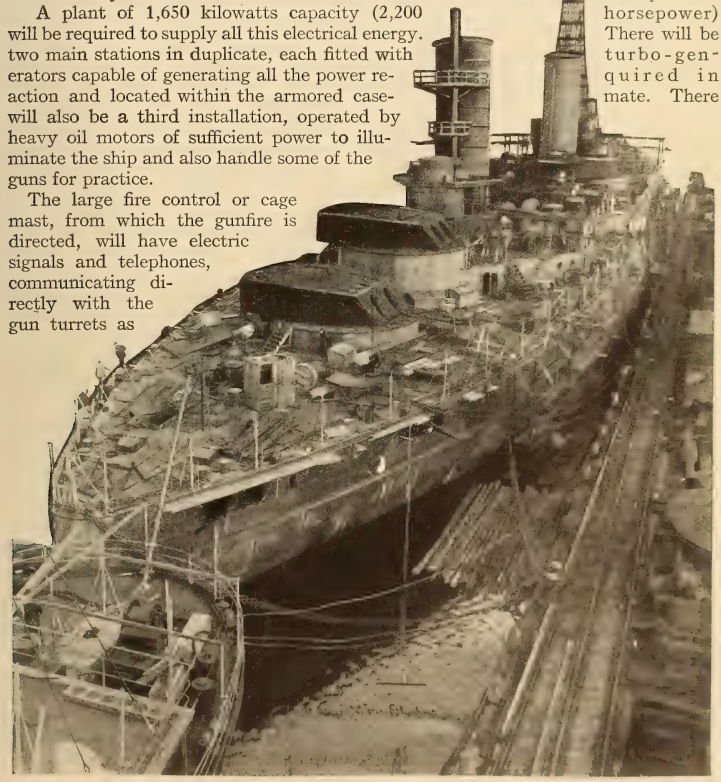
RIVADAVIA—THE GREAT ARGENTINE BATTLESHIP

A new record for size and power of armament of battleships is made every few months. For a fleeting moment this record is held by the Rivadavia, the new Argentine battleship now almost completed at the Fore River Works, Quincy, Mass. It will be turned over to the Argentine government complete in every respect down to dishes, table linen and silver and the piano in the officers' quarters.

Twenty-seven thousand tons is the displacement of this monster fighting machine, and throughout its vast bulk the workings of electricity are found in all phases of its intricate organization. The lights, signals, telephones, ammunition hoists, gun firing and controlling mechanism, searchlights and a hundred and one other devices are operated by electricity for the simple reason that it is the most efficient, safest and surest form of energy to use in the restricted spaces and amongst the terrific dynamic forces that lie dormant in the hull in the form of explosives.

A plant of 1,650 kilowatts capacity (2,200 horsepower) will be required to supply all this electrical energy. There will be two main stations in duplicate, each fitted with turbo-generators capable of generating all the power required in action and located within the armored case-mate. There will also be a third installation, operated by heavy oil motors of sufficient power to illuminate the ship and also handle some of the guns for practice.

The large fire control or cage mast, from which the gunfire is directed, will have electric signals and telephones, communicating directly with the gun turrets as



well as with the engine room and other parts of the ship. Intercommunicating telephones are everywhere, and there will be submarine signal apparatus.

Below the waterline the ship will be protected with a double bottom transverse and longitudinal bulkheads, dividing the vessel into watertight compartments, fitted with electrically driven centrifugal pumps.

In the work of building this ship, hoisting the huge parts into place, giant electric cranes, one of them the largest on the Atlantic coast, if not in the country, were used.

Concrete Poles Molded in Sections

A device here shown and on the market will do much it is claimed to simplify the erection of concrete poles for transmission and telephone lines besides making possible the transportation of poles in sections to points away from railroads.

MACHINE FOR MOLDING CONCRETE POLE SECTIONS

A wheel like, iron structure carries a series of molds of different sizes to the number of 54 upon its periphery. In the molds are formed concrete pole sections nine inches long varying in diameter from seven to eleven inches. In erecting poles these sections are placed one upon the other, those of lesser diameter being used as the top of the pole is approached. Through four holes in every section steel rods are passed to hold the built up pole together. Poles may be lengthened or shortened at any time by adding or taking away sections.

An Electrical Fancy

The following is a free translation of a sketch in a Parisian paper wherein is neatly satirized the astonishing progress of electrical science. This sketch pictures Edison in his laboratory, hearing the news of a declaration of war between the United States and Great Britain. A young man, his assistant, rushes in, pale and out of breath and exclaims:

"War is declared! It is terrible!"

"Ah," says Edison. "War is declared, eh? And where is the British Army at this moment?"

"Embarking, sir."

"Embarking where?"

"At Liverpool."

"At Liverpool—yes. Now, my friend, would you please join the ends of those two wires hanging there against the wall? That's right. Now bring them to me. Good! And be kind enough to press the button."

The assistant, wondering and half-amused, presses the button.

"Very well," says the inventor. "Now do you know what is taking place at Liverpool?"

"The British Army is embarking, sir."

The inventor pulls out his watch and glances at the time. "There is no British Army," he says, coolly.

"What!" exclaims the assistant.

"When you touched that button you destroyed it."

"This is frightful!"

"It is not frightful—it is science. Now every time that a British expedition embarks at any port, come and tell me—tell me at once. Ten seconds afterwards, such an expedition will simply be out of existence, that is all."

"There doesn't seem to be any reason why America should be afraid of its enemies after this, sir."

"I am inclined to share your views," says Edison smiling slightly. "But in order to avert any future trouble, I think it would be best to destroy England altogether."

"To—to destroy England, sir?"

"Kindly touch button number four there."

The assistant touches it. The inventor counts ten.

"—eight, nine, ten—it is all over. There is no more England!"

"Oh! Oh!" exclaims the young man.

"Now we may proceed quietly with our work," says the great man. "And if we should ever be at war with any other nation, you have only to notify me. I have an electric button connecting with every foreign country which will destroy it when pressed. In ten minutes I could destroy every country in the world, the United States included. Be careful, now, that you don't touch any of those buttons accidentally—you might do a lot of damage!"

Dr. Infroit's Radiographic Laboratory

Dr. Infroit, the Paris scientist, for 29 years head of the laboratory at Salpetriere is henceforth to devote himself exclusively to experiments with radium, and has constructed for himself a radiographic laboratory in which to perform his experiments. It is dangerous work that this scientist has undertaken, and sooner or later it may mean his death. He has already felt its effects. Radium, it is well known, when one is exposed to its rays constantly in experimental work, creates a skin disease which gradually penetrates the flesh until the affected member has to be amputated to save the rest of the body. This wonderful mineral, which has such curative powers, can also be very destructive at times. Dr. Infroit first lost a finger. Then a hand was amputated. He was attacked by the disease back in 1908. But since then he has never faltered in his work. He did not stop his experiments even until his hand was healed. Now he has decided to give up his entire time, and perhaps his life to experiments in the cause of humanity and scientific knowledge. The illustration shows him in his radiographic laboratory with two assistants.

DR. INFROIT IN HIS RADIOGRAPH LABORATORY

Hornum Lighthouse

One of the finest of the world's electrically equipped lighthouses stands on the coast of Germany. The tower of the Hornum lighthouse is of steel and from it shine two electric lights with a third light for range purposes in a secondary structure half a mile distant.

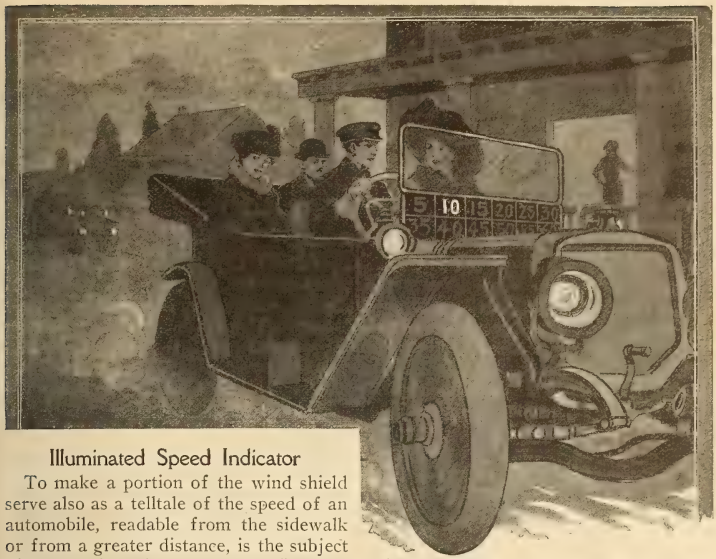
Inside the main tower are installed on the ground floor duplicate twelve horse-power Diesel engines direct connected to duplicate generators. This plant is used to charge a battery of 100 storage cells on the floor above and is accomplished in six hours. The battery will then run the three lights for ten hours.

The floor above the battery is fitted up as a bedroom, and the floor above this is the watch room with a telltale switchboard and a telephone to the engine room and keeper's dwelling. There is also an automatic device by which the generating set on the ground floor can be stopped either from the watch room or battery room. Above the watch room the secondary light shines from the main tower, the rear light of the range, the front light being about half a mile away. The front and rear lights each consist of two 150 candlepower incandescent electric lamps, the one in service and the second directly behind (not in service). In case the service lamp should be broken the current automatically (by the short circuit caused by the broken lamp) turns the table on which the two lamps are mounted and throws the spare one into focus and lights it. The main light in the tower is an arc lamp. The difference between this lamp and the ordinary arc lamp is in the arrangement of the carbons. The positive carbon is horizontal while the negative carbon is placed in an inclined position to the positive, the two forming an angle of 70 degrees. For the lighting effect only the crater of the positive carbon is taken into consideration. The positive crater is clear of the negative carbon entirely, so that the total amount of light given out may radiate. Automatic mechanism in the form of shutters cuts off the light in groups of two flashes alternating with groups of four flashes repeating again in 30 seconds.

HORNUM LIGHTHOUSE

Economy of Electric Ware

Electric ware is not only convenient, sanitary and safe, but is economical as well. The electric toaster stove requires 500 watts or one-half kilowatt. If the rate is ten cents per unit or kilowatt hour, you can cook on the toaster stove a full hour for five cents. The electric heating pad consumes 55 watts.



Illuminated Speed Indicator

To make a portion of the wind shield serve also as a telltale of the speed of an automobile, readable from the sidewalk or from a greater distance, is the subject of a patent issued to Forest Lee Cantrall, Ivy, Calif.

The lower part of the shield proper consists of compartments upon the glass front on which are numbers in successively increasing values beginning with five. In each compartment is an electric lamp backed by a reflector. Under the needle of the speedometer are electrical contacts so arranged that as the needle moves over the scale to indicate the speed these contacts are closed one at a time through a battery thus lighting up the proper lamp and displaying the number showing the speed.

Mineralized Carbon Lamp Electrodes

Arc lamps with mineralized carbons have been in use for some time in France and are believed to be more efficient than any other lamp yet invented; that is, they give more light per unit of energy consumed. As they yield a spectrum more nearly like that of the sun than other artificial lights, they may prove valuable in many ways where other lights are unsatisfactory.

They have had, however, a serious disadvantage, as the vapors from the burning carbon have been found to condense on the interior of the globe and thus obstruct the radiation of the light. This has been recently overcome by the adoption of a double, closed globe, such that one part is used for the glowing carbons while the other part acts as a condensing chamber. With this arrangement it is found that the formation of the gases is lessened on account of the limited air supply, and what does form is condensed in the lower chamber. The fumes are principally fluoride of calcium and nitrous vapors resulting from the direct combination, at the temperature of the arc, of the nitrogen and oxygen of the air. These vapors are more abundant in lamps with mineralized carbons than in ordinary lamps, on account of the higher temperature of the arc.

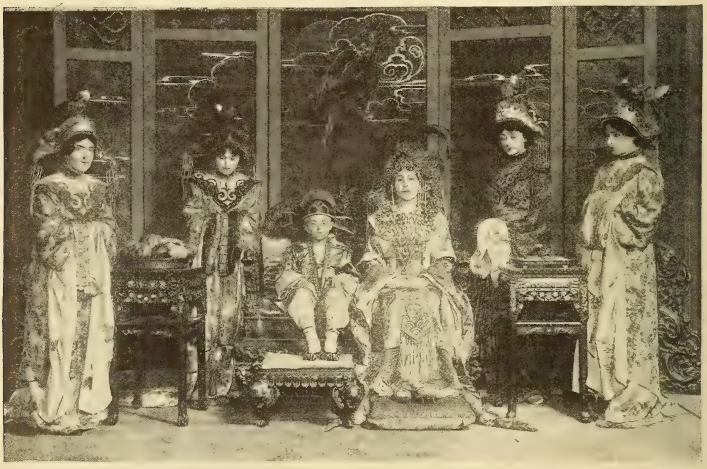
The Daughter

By EDWARD

Through the curtain there percolated low rumblings, explosions, a confusing sound as of many bodies moving, gruff heralds of battle. Then there came a pause, a lull in the firing, absolute silence as if the voice of destruction were taking breath for some greater effort yet to come.

In the darkened theater people began to show uneasiness. One heard whisperings, shifting of feet. The audience, strangely affected by this unseen disaster, waited nervously for the curtain to rise. And then of a sudden it shot up, curled its soft folds into the flies, exposed a dimly lighted stage and on it a grim picture. There behind the footlights lay the battlements of Nankin—red battlements with the dead and dying of the Ming army strewn about them. Now in the black reaches of the sky one saw flashes of fire, splitting forks of yellow and red, heard shells burst filling the air with their terrible crashing. Then the wall began to fall in, great blocks of stone tumbling down upon the stage pinning men as they fell. And the din continued, the bursting shells, the rattle of musketry, the waving of signal fires.

How long this lasted I cannot say. All sense of time had gone. Only could one think of the falling battlements, the thunder of cannon, the spreading smoke, the cries of the soldiers of Ming. And then The Daughter of Heaven, empress of a lost dynasty, a little woman armored in gold, in allegiance for whom her loyal subjects had risen in revolt,



VIOLA ALLEN AS THE DAUGHTER OF HEAVEN, AND HER ATTENDANTS AT THE MING THRONE

# of Heaven

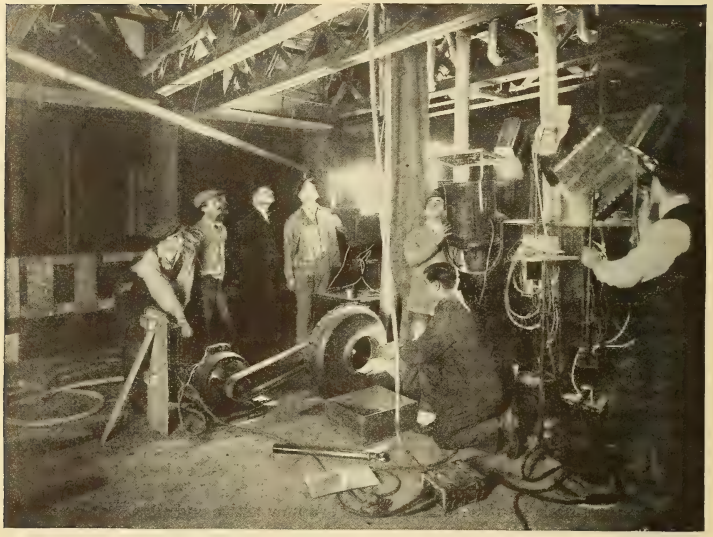
LYELL FOX

crossed the stage. I saw her pick up a torch and hold it overhead. Her soldiers had gathered around her. The day was lost. The Manchus were carrying all before them. Soon they would come swarming over the battlements. And the loyal Mings were pleading of her a last dispensation, begging a favor. She, their Empress, must light with her own hands the funeral pyre upon which they would all burn. They prostrated themselves before her.

And then I noticed a great pile of logs off in a corner of the stage over at the end of the wall. They looked like railroad ties piled up beside a track. Silently The Daughter of Heaven approached them. I saw her torch ignite, suddenly bursting into flame. I saw her thrust it deftly among the logs, lighting them all with swift precision. And then she tossed the torch into the middle of the pyre and escaping by a secret passage that ran under the city, left the scene. So much for the little woman in the armor of gold.

Now a puff of grayish smoke issued from between the stacked logs. Then it thickened, more and more of it, darker and darker until it swirled and eddied in an ecstasy of destruction. Through it one caught a glow of red, faintly visible. Then the glow brightened, spread and spread until it licked at the end of a huge block of wood and ran down it—fire, suddenly born now active and alive. Brighter and brighter it glared, encompassing all until the pyre had become a roaring car-

WHEN THE FORBIDDING RED LIGHT PLAYS OVER THE PAVILION AT NANKIN



A PECULIAR GROUPING OF PIPES, REFLECTORS, FANS, MOTORS AND LIGHTS—THE "FIRE" MACHINE

nage, red with fire, gray with smoke. It hissed, it crackled, it moaned. And into the hell of it I saw the soldiers of Ming, one by one fling themselves upon the logs and lie still. The curtain fell.

It was to discover the illusion, to spoil the effect that the scene had for me that I went to the Century Theater the next afternoon. I was to see the big scene of The Daughter of Heaven from a viewpoint that would forever spoil for me the illusions of the theater. And so I invaded that magic land of behind the scenes, was conducted through many mysterious passages and finally found myself standing in a cellar sort of a room such as one finds in an empty warehouse. Just below a trap in the stage it was and as I passed through a little door I saw before me a peculiar grouping of pipes, reflectors, electric fans, motors and lights.

I learned that the peculiar machine was most intricate. The pipes were for smoke. At the bottom of each was placed a chemical smoke pot that subsequently made grayish clouds issue from the pyre above. I saw a big circular piece of amber gelatine which when played upon by the powerful electric light would produce the color of fire. I saw thick silken brushes, imitations of feathers, orange colored, hanging like the plumes of some huge hat. I saw powerful bellows that driven by large electric motors would send the feathers swirling around, bright in the glare of the pyre—bellows that created the impression of whirling fire. And these motors made the smoke eddy too. Everything depended upon them. Even the gusts of confetti that thrown into the air, were caught in the breeze of six electric fans and made to whirl round and round like flying sparks—even they relied upon the big motors.

And that was the fire-colored light, whirling feathers and confetti, smoke pipes and pots, bellows, fans, a motor. And it came to me how surprisingly it all depended upon electricity.

My guide's name was Bierwald, "Bennie" they called him. I met him at the Tyler offices up in the Century Theater. As you may know it is the firm of George Tyler & Co., that produced The Daughter of Heaven; also The Garden of Allah which last year opened a new era in impressionistic staging. And Bierwald is their master electrician—an artist in lights, a painter who paints with candlepower instead of with a palette and brush.

I was fortunate in having him as my guide. He took a delight in explaining the illusions he had created. It seemed as if I were a little boy, and he, an old man grinning and saturnine, was saying over and over—

"There isn't any Santa Claus! There isn't any Santa Claus!"

It began before the first curtain had risen. The stage was set for a scene called "A Chinese Love Song." It had no bearing on the plot. It was just a picture that created a mood. I saw the soft landscape of a river dancing in moonlight of a glowing oriental sky rich in purple, of fireflies twinkling in the foliage of a wood. It was very vague, dim, indistinct; yet surprisingly beautiful.

That was because the picture was soft. There were no stiff wing pieces. The audience gazed upon it through a curtain of gauze and even the moonlit water was different. I was going to ask Bierwald about it, when there came from just behind me a low whirring, the subdued sound of machinery. I turned and saw a "Kinemacolor" apparatus. On the drop it was creating an actual picture of water in moonlight—a greenish, yellow flow that brought out the rare quality of the scene.

"I thought they always did moonlight and water by a stiff magic lantern sort of an arrangement," I said to Bierwald. "I thought they just projected it from the wings."

"They do," he replied, "but not here. That kinemacolor stunt cost the producers an extra thousand dollars."

And that, too, was made possible by electricity. I saw the wires leading to the machine.

We hadn't walked two feet before my foot caught in something in the floor and I realized that not only was The Daughter of Heaven different but the Century itself was different from any theater I have ever seen. My foot had caught in an open space in the floor—a complete circle as I afterwards found. For the stage revolves and that was the slot. Underneath it are the great motors that turn it—turn it and the weight of all the heavy scenery in place above. And I saw that while the audience was gazing upon the moonlit water a swarm of scene shifters were transforming the other half of the stage into "The Council Room at Pekin." So massive is the production, so intricate the scenery, that only on a revolving stage could it be done full justice. Without the arrangement whereby one set can be put in place while the other is being played upon the delay between acts would be so long that the audience would become restless—maybe bored.

Three stories under the ground we followed a staircase and there saw the huge switchboards that control all the lights in the house, the huge motors and the engine room. Then when I felt as if I had been through some huge power plant Bierwald led me up an exceedingly narrow spiral staircase, told me to go ahead and hung back himself. The next moment I found myself in a queer little compartment, its ceiling so low that one had to stand half crouched. I saw a man seated before a little shelf on which were many electric switches. He smiled and whispered for me to look around over my shoulder. I did and was astonished to find myself gazing into the face of a big Chinaman!

THE FUNERAL PYRE—STANDING BESIDE IT, IN THE FOREGROUND, IS BIERWALD, THE STAGE MAGICIAN

I was under the stage, in a little depression, just behind the footlights, in an open trap that was screened from the audience by the footlight reflectors. And here, I learned, sat the man who painted in the picture with the colors that Bierwald had devised. He was at the master switchboard from which every lighting effect is made. In every other theater this board is located in the wings. Here it is in midstage where its occupant can view his picture perfectly with no strained or inaccurate view so often caused by the angle of the wings.

By the time we got back to the wings the stage hands were finishing their work on the battlements of Nankin—the same as we first saw at the opening of this article. I saw the torch that the Empress had ignited. At the end was a cluster of tiny glass bulbs painted red. She had lighted them by pressing an electric button on the handle. Not even the smallest of properties could escape this dominance of electricity.

Over at the left of the stage the director of the battle took his seat in the "prompt entrance." Near him swarmed the Chinese soldiers—real jabbering Chinamen obtained from New York's Chinatown and demanding four times the pay of the ordinary "supe." But having seen the battle from in front, from below, I asked Bierwald to take me behind the back drop—a black square lighted from the wings with a reddish glow.

Here we found a number of batteries strewn about. We saw men kneeling beside them ready to press the buttons that would send a flash of electricity up through the long vinelike black wires and explode the bombs. Held in glass faced boxes, these were fastened to the drop. Then Bierwald told me that the bombs were different from the ordinary.

He said they were placed in boxes, one side of which was ground glass. On the glass was painted the picture of a bomb bursting. Behind it were the magnesium bombs exploded by the electric wires. So was a very wonderful effect created, an actual explosion heard—a picture of what a real bomb looks like, revealed to the audience.

And when I began to wonder if some uncanny electrical forces were not pushing in the battlements and tumbling their *papier maché* blocks on the stage, Bierwald overwhelmed me by explaining the last scene of the play.

It is the throne room at Pekin. The Daughter of Heaven, slowly dying from the poison she had taken, is sitting on the throne of the hated Manchus. The Emperor—the lover from whom tradition had parted her—is waiting below with his nobles. At the sight of her dead, the emperor lights the great jars filled with incense and burns a funeral farewell. Instantly the electric blower gets busy under the stage and forcing a cloud of perfumed smoke through a pipe empties it out into the jar and sends it drifting lazily into the air. And the curtain falls with the Tsin emperor and his nobles prostrating themselves before the pale and still Empress of the Mings.

As it has begun so has the drama ended with its significant effect, electrical.

Afterwards Bierwald took me up into his workshop and told me the secret.

"Our whole system of stage lighting," he said, "is new. It is new because it is impressionistic and creates moods. It is the method we began with the 'Garden of Allah' and which we are carrying out here on a larger scale. We colored scenes for instance, harsh red, a color that may not be in Nature. We did it so the audience would feel the sense of disaster.

"We colored a moonlight scene with a strange greenish tone just to produce in the minds of the audience the spirit of the play. We use a peculiar purple in the last act to give intense emotion, grief. We do this to 'get over' the spirit of the play. It may not be true to Nature but we contend that to create moods, to hold people's minds by the psychology of color, by their skillful variations is a vastly bigger, more important and more intelligent thing than to set a stage with real doors, real Turkish rugs, real lamps, and all the other clutter of the school they call realistic!"

White and Black Coal

The French call the power derived from waterfalls *houille blanche*—"white coal;" and a singular combination of the power derived from white and black coal has been effected at Etupes, in eastern France. At that point electric conductors coming from the coal mines of Ronchamp, eighteen miles north of Etupes, meet similar conductors coming from the waterfalls of Le Refrain, 24 miles south of Etupes. The current derived from the mines is of 30,000 volts, and that from the waterfalls of from 30,000 to 50,000 volts. At Etupes the power is combined in a large plant, provided with transformers and distributors and sent out to run shops, light lamps and so forth. It is estimated that ultimately this alliance of white and black coal will furnish 50,000 horsepower.

Rathenau Medal

Dr. Emil Ratheneau, a lifelong friend of Mr. Edison and head of the Allgemeine Elektricitäts Gesellschaft (General Electric Company of Germany), has placed a medal in the hands of the American Museum of Safety, New York, to be given each year for the best device for safeguarding life in the electrical industry. The medal, which goes this year to Mr. Edison, bears upon one side a picture of Dr. Ratheneau and the words "Emil Ratheneau, 70 years old, Dec. 11, 1908," in commemoration of which the medal was founded. The other side bears four German words meaning "for merit and fidelity."

"Eating Electricity"

An Interview with Prof. Bergonie, Discoverer of the Worth of High Frequency Current as a Body Builder

By FRANK L. HALSEY

When my chief in London cabled me, his Paris correspondent, "See Prof. Bergonie, Bordeaux, eats electricity," I was, to say the least, a trifle startled. A man who eats electricity, indeed! Was he then some son of Jove who for the mere pleasure of it nibbled at his father's thunderbolts—lunched off the lightning? My vision conjured up a man of great build, of god-like stature as the ancients imagined it, while the train bore me on toward the town that held the marvelous personage. Bordeaux is a far cry from Mount Olympus and so when set down in its streets, I felt that perhaps after all it was no semi-immortal whom I was to visit, but a scientist.

Such a man did I actually find Prof. Bergonie, seated in his office-laboratory, somewhat taciturn but keen as one of his own electric sparks. There was nothing of the immortal about him; he was a man of average size and with no particularly distinguishing feature, a man whom you would pass on the street without a thought of what was stirring behind the rather broad and high forehead. Is this the man who derives nourishment from the lightning, I asked myself. I set about to learn how, and why.

Prof. Bergonie was courteous. "You are a journalist, Mr. Halsey? Ah yes. And you want to know how I 'eat electricity'? That is rather obscure; it does not at all convey the purpose of my recent discovery. That purpose is to supply the body with a great quantity of heat without overtaxing the digestive organs which Nature designed to serve that function. In the first excitement of the newspaper world when I made known my method of supplying this heat, it was stated—you will pardon me—with not unusual exaggeration that I had discovered how to do away with food entirely, furnishing by means of electricity all the nutritive benefits derived from animal and vegetable matter. That is simple nonsense. Following that line of thought—their own, mind you, not mine—the journalists made me say that an electric current of 1,000 volts is equal in food value to a porterhouse steak. Think what my confrères in the Academy of Science must have thought of me to see that statement apparently emanating from me."

The professor broke off his narrative to rise and pace about in some excitement; finally he halted before my chair.

"What I told the Academy" he resumed, "was that diathermy, the method of applying a current of low tension and high frequency as discovered by Prof. D'Arsonval could be made to partly supplant food, by supplying the body with a great quantity of heat. The daily food of a normal person furnishes about 3,000 calories, the calorie being the unit of heat. By applying D'Arsonval's current with an intensity of from two to three amperes and at a voltage of from 1,000 to 2,000 about 1,000 calories an hour can be supplied.

"The current traverses the body without provoking the least pain. Imagine what that will mean to those whose digestive organs are out of order and who still are in need of their daily heat supply. A man cannot force his stomach and the supplementary digestive tracts beyond a certain point. If for any reason those organs are incapable of furnishing the necessary amount of calories, he loses weight and his case is diagnosed as one of malnutrition. He may be drugged into some semblance of a normal condition but the action of the medicines is quite as likely to merely shift the seat of his

trouble. That is where the electrical applications solve the problem."

"But, Professor," I interjected, "can you give me a proof, a concrete example of the good to be derived from your method?"

"Most certainly I can. At first I had experimented with the applications upon myself, but being in a normal condition at the time I could not be positive of any good that accrued to me from them. Possibly I felt improved to some slight extent but I could have laid it as well to atmospheric exhilaration as to the electricity. Therefore I sought among my medical friends for word of a patient who would be willing to gain possible relief and no harm from the experiments. I was fortunate. A man living here in Bordeaux had sought aid from a physician. He was of average height but when stripped was thin almost to the point of emaciation. What was more he continued to lose weight and naturally was in a weakened condition. He declared that his appetite was good and that he ate large quantities of meat but he always felt very cold. When sent to me he had scarcely strength enough to walk.

"Here was the very subject I desired. I began the applications at once. Each one lasted 40 minutes, during which time the patient absorbed 1,700 calories. You will understand that this was an extreme case and therefore called for a lower amperage and higher voltage than I would usually recommend. At the end of the series of treatments I was rejoiced to see that the patient's weight had increased considerably and that he had far more energy. Moreover, he was eating far less than when he came to me. Is not that a proof that to a large extent electricity can replace food."

Prof. Bergonie smiled.

"I am not trying to urge the elimination of all food and the replacing of soup, meat and vegetables by a purée of amperes and a filet of volts," he declared, "for in that case I would be flying for my life before a horde of enraged market men. It is an impossible thought that electricity can ever fulfill all the functions of food but I will say this in all seriousness: the time is not very far distant, in fact we will both probably live to see it, when all troubles arising from insufficient food, the disorders of metabolism, will disappear before a reasonable application of the high frequency current."

I left Prof. Bergonie with the pleasant impression of a man who knows he is on the right track toward being of help to humanity and rejoices that he can ease the ailments of troubled humanity. In view of his ideas, though, could I resist the thought that his background of working tables with battery jars and generators on them might be a prophecy of the dining tables of the future?

Canadian Farmers use Niagara Power

The farmers in the central sections of Ontario, Canada, have joined hands with the Hydro-Electric Power Commission to solve their rural difficulties in a rough but effective way. In one county the commission has commenced the construction of a trunk line, but the farmers will build the branches under expert supervision. The swamps will yield the poles and the farmers will haul them out and do the digging and erection. Upon such a coöperative contract the rural communities have entered with eagerness and some of the farms will be equipped with electrical power by the beginning of next summer.

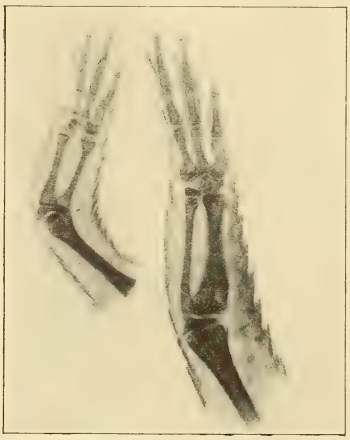
An instance of how the propaganda has taken hold is the extension of a dairy farm near Beaverton to accommodate 210 cows, all of which will be milked by electricity. The owner milks 75 by that method at present and his neighbors are preparing to discard the old hired man arrangement as quickly as the government can bring them the condensed energy of Niagara Falls.

The Hydro-Electric Commission of

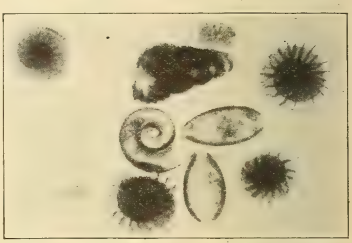
Ontario was organized on application of a hundred or more municipalities and financed with public money. The commission undertakes the construction of all transmission lines throughout the province, while the municipalities are responsible for construction and distribution within their own borders; in other words the commission is the wholesaler and the towns and cities the retailers. Recent legislation has placed in the hands of the commission almost autocratic powers of control over the municipalities, such as their rates of charge, the standardizing of equipment, the disposal of surplus profits and other points whereby the efficiency of the commission shall not be jeopardized by carelessness or incompetence of local bodies.

Microradiographs

M. Pierre Goby's new X-ray method is likely to work a revolution in microscopic work, as this is the first time that the rays have been applied so as to show up the internal structure of minute specimens, although we are familiar with the results which are obtained with ordinary sized objects. He uses a special electric apparatus for producing the X-rays, and combines this with microscope devices in such a way that the rays show the otherwise invisible parts within the minute objects. It would be difficult and in the majority of cases impossible to see the structure in any other way.



FROM A MICRORADIOGRAPH OF THE FORE AND REAR MEMBERS OF A SMALL LIZARD



A PINCH OF SAND FROM THE SEASHORE CONTAINS MINUTE SHELLS. A MICRORADIOGRAPH SHOWS THE REMAINS OF LIVING ANIMALS

As an example, take a pinch of fine sand from the seashore. Putting it under the microscope we often find that it is made up of very minute shells which could not be detected by the eye. But M. Goby's apparatus now allows us to go farther and see the inside structure of the shells or other remains of living animals and he even discovers new species in this way where naturalists could not detect any difference from a simple outside examination of the specimens. The structure of the objects often reveals a regular design which is very attractive.

Not only can the X-rays be used with microscopic specimens, but even small animal specimens can be examined by magnifying them, say up to 20 diameters. For instance, we illustrate some of the parts of a very small lizard from the south of France, and it would be hard to observe these by the ordinary X-ray method. Now the parts, such as the minute bones and other details, are very distinct. The inventor is working on his apparatus at Grasse, France, and promises a more complete description later.

Courtesy of The Illustrated London News

THE REVEALING RAY

This picture from a sketch by a newspaper correspondent with the Turkish Army, vividly portrays victorious Turkish infantry, preceded by the revealing ray of a powerful searchlight, entering the village of Papas Burgas at midnight, on Nov. 17 of last year just as the Bulgarian forces were withdrawing. After the day's battle had silenced the Bulgarian batteries, the Turks secretly placed a searchlight on a hill overlooking the town and at midnight as it flashed down upon the startled village the ghostly, unheard-of scene here depicted took place.

THE FAMOUS AERIAL ELECTRIC CABLEWAY IN THE TYROL IN WHICH SIXTEEN PEOPLE MAY RIDE AT ONCE FROM ONE STATION TO ANOTHER 2700 FEET HIGHER UP

How the Swiss Exploit Their Scenery

By FRANK C. PERKINS

It is said that many of the Swiss people who love their mountains and enjoy the beauty and grandeur of the Alpine scenery regard with disfavor the commercialization of these things as exemplified by the scaling of mountains by trolley cars, building mountain hotels and stretching great lines of aerial cableway among the giant precipices. They cannot be blamed for taking this view of the matter, but at the same time they should remember that these modern facilities for travel—brought about very largely by electric power from the glacier fed lakes —enable tens of thousands of people to view the wonders of the Alps who could not do so if it were only possible with the aid of Alpinestock and hobnailed shoes.

After all it is the tumbled peaks, the stupendous distances, the great, silent masses of ice in glittering splendor lying so peacefully miles and miles away up in the air that grip one. A hotel or two, a few hundred yards of track or even a grotesque, cable-slung car in the foreground is of small consequence. It is a simple matter to change one's point of view a little to cut out of sight these man made contrivances and then again gaze at crag piled upon crag, as elemental in their grandeur as the day they were tossed up from the level.

Frequently in the past these pages have contained descriptions and illustrations of the great work which is being done in "electrifying the Alps." But the story is one which does not grow stale so long as pictures of these regions can be presented. To picture the Matterhorn, the Jungfrau or the great Grindelwald glacier hardly needs excuse though they have been seen and studied many times before. And it is pleasurable at the same time to look forward to the day when either the government or private enterprise shall make our own Rockies, perhaps as splendid in every way, just as accessible as the Swiss Alps. It is scarcely fitting that to tread great glaciers and be inspired by snow capped peaks so many of the people of this country should first go through a period of seasickness to view other people's scenery.

One way the Swiss have of making mountain climbing easy and attractive to visitors is shown on the opposite page. This is a famous aerial electric cableway in the Tyrol. Sixteen people may ride in the car at one time. From the lower station you are drawn up by a hauling cable, winding over huge drums driven by motors, and step out at the other station over 2,700 feet higher up. And all through the journey you view the most entrancing scenes at the same time that you are thus easily overcoming the most difficult bit of mountain climbing in the region, if you were to attempt it afoot.

Over on the next page (No. 3) is a more distant view of a similar cableway, at a point on the Wetterhorn on the way up to the Grindelwald glacier. The little station to which the car is ascending is known as the Station Enge. But the highest cableway in all Switzerland provides tourists with easy access to the top of the Vigiljoch. The difference in level between the two stations is 3,800 feet and the total length along the incline considerably over a mile.

The famous Jungfrau, a favorite with tourists, is now much more accessible, by means of the electric railway which winds gradually up to the Station Eisiner 10,273 feet above sea level. View No. 1 shows a section of this interesting railway.

The Zermatt-Gornergratt mountain railway carries passengers a long way up the lonely Matterhorn. View No. 2 shows one of the rustic stations erected at intervals along this line. So artistic is its conception and so in harmony with its surroundings that one cannot believe

2

3

seriously that it is any great blot upon the natural scenery.

With the development of electric cable, rack and pinion and aerial railways in Switzerland, attention of engineers has been directed towards Mont Blanc, the highest peak in Europe and most famous in the Alpine ranges, with the beautiful valley of the Chamounix leading up to its base. On both French and Swiss sides Mont Blanc is comparatively easy of ascent toward the base and not especially abrupt even in the higher regions.

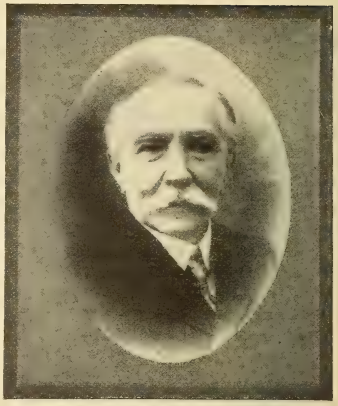
There has been installed an electric rack and pinion road from the Valley of Fayet and Chamounix well up on the side of the mountain. From Fayet it ascends to St. Gervais, from where, by an incline road on a grade of sixteen degrees, it reaches the Col de Vova at an altitude of 5,500 feet.

Charles Bourseul—French Inventor of the Telephone

Le Petit Journal of Paris recently commented upon the death of a French inventor, Charles Bourseul, who died in comparative obscurity, yet who had more title to national recognition by the French people than many recipients of the Legion of Honor. Bourseul was the inventor of a telephone antedating that of Alexander Graham Bell.

As in the case of nearly all great inventions there have been a number of claimants to the honor of having invented the telephone. But, as with Edison and the incandescent lamp, and Marconi and the wireless, the world has come to recognize in Bell the real inventor of the telephone, for he is the man who made it a practicable possibility. Still it is interesting to read of this French claimant.

It was in 1854 that Bourseul, employed in the department of Posts and Telegraphs, asked the French government to take and use his discovery. His superiors did not understand it, and regarded him as crack brained, a man who fooled away his time instead of occupying himself with his work. He told the officials that he had discovered a means of transmitting the human voice a long distance by means of electricity. The only response that he obtained to his statements was that he had better consult a doctor and in an equivalent French colloquialism, "get rid of the bats in his belfry."



CHARLES BOURSEUL

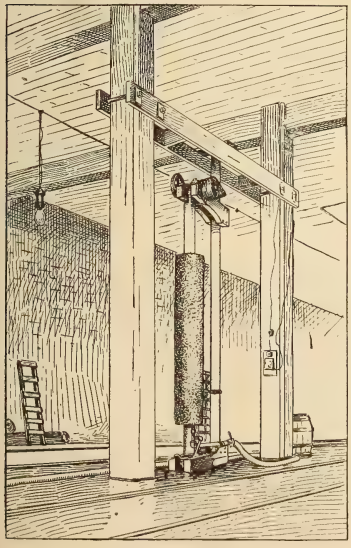
He published his belief in the possibility of what has now become an accomplished fact in the following words:

"Imagine that a person speaks near to a plate which is of such flexibility that none of the vibrations of the voice are lost; imagine also that this plate establishes and interrupts successively the communication with a voltaic pile; under these circumstances it will be possible to have at a distance another plate which will make the same vibrations at the same time."

Seven years later, in 1851, a German, Reiss, took up the work where Bourseul had left it and constructed the first telephone. In 1876 Elisha Gray and Prof. Alexander Graham Bell brought it to its present perfection, Prof. Bell, after long litigation winning final recognition as the practical inventor.

Washing Cars by Electric Power

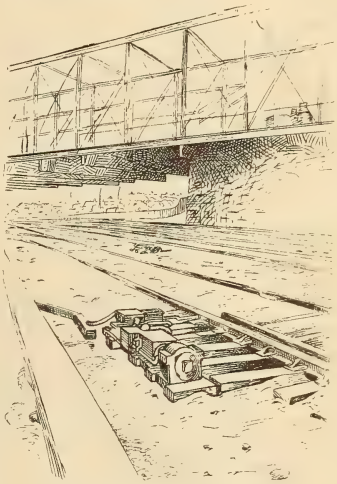
A convenient method of washing the sides of electric box cars is in use in the Seattle, Wash., Electric Railway Company's shops. As shown in the accompanying drawing, the washing apparatus consists of a vertical cylindrical brush piped with water from the shop mains, and driven by a small electric motor mounted on two cross timbers at the top. A car is washed by running it upon a track at the side of the revolving brush, the brush being swung against the windows and panels while a stream of water passes through the space between the bristles. The largest semi-convertible car can be washed in this way in a few moments, and the company obtains a decided saving in labor compared with the old method of hand washing with pole type brushes.



MACHINE FOR SCRUBBING CAR SIDES AND WINDOWS

Electric Motors in Track Switching

Electricity is rapidly gaining ground in the latest railroad work in connection with the movement of track switches. It



MOTOR OPERATED TRACK SWITCH

is free from the troubles encountered in forcing compressed air through hundreds of yards of pipe. In cold weather especially, electricity saves time at points of congested traffic.

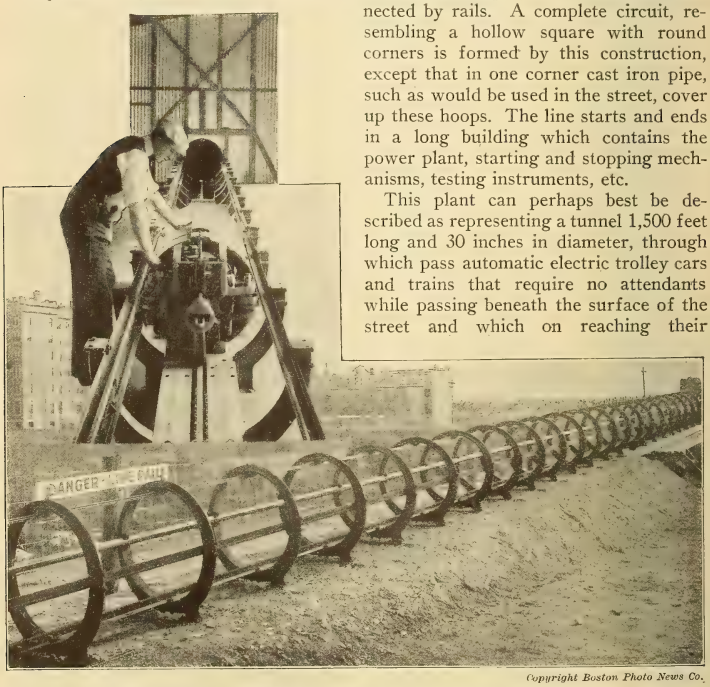
In a typical installation on the Boston & Albany Railroad at Allston, Mass., shown in the accompanying illustration, the motors are located with the switch operating mechanism in the depressed space between tracks and are supplied with electric current from the local central station service. The apparatus works well in the snowy weather of a New England winter. The operator in the switch tower simply pushes the button or pulls a small lever; this starts the motor, which may be made to run in either direction, and the latter opens or closes the switch as the case may be.

Underground Transportation for Parcel Post

The establishment of the Parcel Post in the United States creates many new problems for the post office department to solve. One of the most important of these is that of transporting this bulky mail in the large cities between the main post offices and railroad depots. The rational solution of this problem as worked out by practical post office officials is to connect the more important post offices and depots by tunnels and to thus transport this volume of mail underground.

A system designed to solve this problem is now being demonstrated in Cambridge, near Massachusetts Ave. and the Charles River, and in the rear of Riverbank Court. This system has been installed by the American Pneumatic Service Company. This Cambridge demonstration plant greatly resembles a small scenic railroad; not so small at that, since it is approximately 1,500 feet long. This resemblance is due to trestle work which has been installed in order to provide on this flat river front grades and curves such as would be necessary in actual construction beneath the streets. On this trestle work, and running along the ground from it, is a continuous row of cast iron hoops, which in turn are connected by rails. A complete circuit, resembling a hollow square with round corners is formed by this construction, except that in one corner cast iron pipe, such as would be used in the street, cover up these hoops. The line starts and ends in a long building which contains the power plant, starting and stopping mechanisms, testing instruments, etc.

This plant can perhaps best be described as representing a tunnel 1,500 feet long and 30 inches in diameter, through which pass automatic electric trolley cars and trains that require no attendants while passing beneath the surface of the street and which on reaching their



Copyright Boston Photo News Co.

SECTION OF THE TUBE FRAME OF THE ELECTRIC MAIL CARRIER ABOVE. THE OPERATOR IS ABOUT TO START A CAR BY PULLING THE CONTACTOR AGAINST THE LIVE RAIL

proper station automatically come to a stop. The diameter of this tunnel, 30 inches, is just the height of an ordinary table. A workman could, if necessary, to make repairs, crawl into such a tunnel. The system can, however, be of any diameter. It is designed in particular to cover the field up to a size tunnel in which it would be possible to have motormen on the trolley cars.

The first striking point about the system is that it is automatic, for after the trolley car is once started it needs no further attention either to keep it going or to stop it at its proper station. The second point that immediately impresses you is that this is a mono-rail system; in other words, the trolley car runs on a single rail instead of on two as is the case with most railroads. In addition to this single rail, there is a guide rail on each side of the tunnel to keep the trolley car from tipping over, and a trolley rail on top which acts as a trolley wire and brings the electric power to the car.

The proposed method of building this tunnel is also interesting, as well as most simple. It is expected, with the 30 inches diameter tunnel at least, that in most instances it will consist of ordinary 30 inch cast iron water pipe laid in an open trench. Inside this pipe will be fastened the rails upon which the cars and trains will travel. It is believed that this form of construction will prove very simple and in addition will give a strong and permanent tunnel. Ordinarily two such pipes would be laid in order to give service in both directions as on a double track railroad.

The trolley car is a very substantial looking vehicle. It is about seven feet long and its inside, which is protected by a cover, would easily take in a small man or a boy. It is designed to carry four pouches of mail. The car is shaped something like a torpedo and has bumpers at each end. The motor is outside, although the gears running from it to the driving wheels are enclosed. The car has a sliding trolley contactor. The car also has a reversing switch which permits it to be sent in either direction and a mechanism for moving the car under its own power, but at very slow speed while it is in stations or on sidings.

The motor is of a special design and is the most important part of the car. It is so wound that is has practically a constant speed at all loads and when going up and down grades. This characteristic is, of course, necessary to prevent cars overtaking each other while in the tunnel. The motor is started by a switch which automatically releases itself when the car reaches a certain speed.

Stopping the car by itself, and without the aid of an attendant, is a very simple process. It is similar to that used on the roller coasters seen at amusement resorts. At the end of the line and perhaps for 30 or 40 feet wooden skids are placed just above the mono-rail. There are also wooden skids on the bottom of the car. The car comes into the station, the current is lead off the trolley bar at a certain point and the car strikes the skids and gradually and easily comes to rest.

The Electricity of Drops of Water

When a liquid jet divides itself into drops in the air, it is known that these drops are charged positively, the air being charged negatively. This effect has been used by Lord Kelvin as a means of creating electrical charges; it is utilized also for measuring atmospheric electricity.

Dr. von Bernalak, of the University of Heidelberg, in an article in *Annalen der Physik*, gives us opinion that this production of electrical charges is intimately connected with the formation of drops infinitely small which accompany the principal drops. He establishes the fact that if the number of these secondary drops is increased so as to produce rapidly the large primary drops at the outlet of a tube which has its lower end enlarged, the total amount of the charge is considerably augmented.

THE TELEPHONE CREDIT CHECK SYSTEM IN OPERATION

A Telephone Credit Check System

In large department stores where goods are sold on credit, a system is necessary for checking the credit standing of customers at the time of the purchase. A system for this purpose was recently installed in the new Rothschild department store, Chicago. The two requisites, speed and accuracy, are attained by means of telephones placed at wrapping desks throughout the store. These telephones are fitted with a special electrical stamp controlled by a separate circuit which permits an o. k. from the credit office being printed on the inserted sales slip. In the credit department is located a switchboard controlled by an operator who switches the calls received to the girl handling the particular section of the alphabet in which a customer's name is located. The credit files in the form of card indexes are conveniently located in front of each girl and to each is assigned one of the six divisions. For example, girl No. 1 has charge of all calls from A to D, etc.

If a customer, S, desires to have a purchase charged to her account, the cashier-inspector at the station where the goods are bought inserts a sales slip under the little hood attached to the telephone standard, calls for authorization clerk No. 5, hangs up her receiver and resumes her duties.

In the credit room the operator switches the call to clerk No. 5 and a lamp is lighted in the board at her desk, which indicates that a credit is ready to be passed upon. The lamp remains lighted until the call is answered. Clerk No. 5 then calls the inspector, who gives the name and address of the customer and the amount of sale. The inspector then hangs up the receiver. Referring to her cards, clerk No. 5 ascertains the customer's credit standing and if found satisfactory presses a key which prints an o. k. on the sales slip which was inserted in the instrument down at the sales counter. If there is a question about charge, the customer is asked to call at the office of the credit manager, where it can be properly adjusted.

Street Lights Along the Curb

A plan to aid in finding house numbers at night and at the same time to illuminate the street by throwing the light from the curb directly over the surface of the roadway is here illustrated.

CURB STREET LIGHTS AND HOUSE NUMBERS

Within a metal hood open upon the side towards the street is an incandescent lamp. The hood is secured to the cement curbing by bolts embedded in it. The interior of the hood is lined with a reflecting material and upon the base of the hood facing the street is a beveled edge for the street number. The hood is arranged so that the lamp is locked in. The lights may be replaced in a staggered position as shown affording a light free from shadows at the street surface. The idea is patented by Thomas S. Brown, Hemet, Cal.

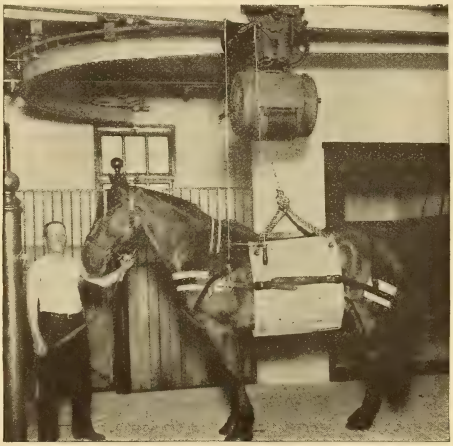
In Recognition of Faithful Friends

The homeless cat, the stray dog and the injured horse have received a recognition of their devotion to humanity in the opening of a hospital for them at East Twenty-fourth Street and Avenue A, New York City.

The hospital, which is a three story building, was built by the Society for Prevention of Cruelty to Animals, is provided with everything necessary to care for its patients, including even a roof garden for their exercise, and affords an example of the modern applications of electricity.

According to the *Edison Monthly*, a sick or injured horse is brought to the hospital in a specially built ambulance. An electric elevator conveys ambulance and horse to an upper floor where an electric one-ton hoist upon an electric trolley lifts the animal clear of the floor if need be and conveys it to the operating room. A $1,200 operating table with adjusting mechanism enables the surgeon to place the horse in any desired position. This room is lighted by 44 electric lights and contains operating tables for handling dogs and cats.

CONVALESCING UNDER THE ELECTRIC BLANKET



FROM ELEVATOR TO OPERATING ROOM BY TROLLEY

Cats and dogs are kept each in neat clean cages properly lighted by electricity and even provided with electric warming pads where needed. A place is also arranged in which to keep dogs suspected of rabies.

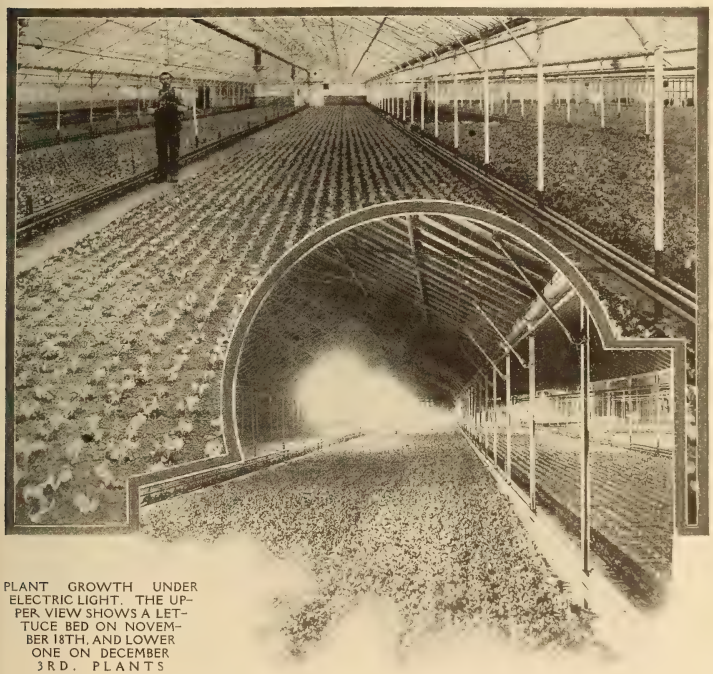
In the horse ward are box stalls, all lighted by electricity, and also a "threshing stall" with sixteen inches of peat moss on the concrete floor where a horse suffering from colic may be confined.

As in hospitals for human beings, there is a contagious ward, with electric lights shaded to protect the eyes of the dumb patients from the effects of the glare.

Piecing Out Daylight to Hasten Plant Growth

Experiments have been made at the Cornell (N. Y.) Experimental Station, at the West Virginia Station and by W. W. Rawson, a well known vegetable grower of Boston, to determine whether electric light, either arc or incandescent, can be advantageously used upon lettuce to piece out the sunlight in midwinter, and the accompanying pictures show the interior of the Walla Walla Hothouse Vegetable Company, Walla Walla, Wash., where excellent results are also being attained. A partial view of six flaming arcs can be seen in the daylight picture.

Regarding results Mr. F. E. Mojonnier of the company says, "The daylight picture shows in the foreground a bed of lettuce transplanted a week before this picture was taken. The night picture shows the same bed of lettuce taken from almost the same spot sixteen days after the first picture. During this period the lights were turned on continuously at night and the great growth secured must be attributed to the effect of the light, as from my experience it is impossible to make such a growth in winter in that time when the days are short and often



PLANT GROWTH UNDER ELECTRIC LIGHT. THE UPPER VIEW SHOWS A LETTUCE BED ON NOVEMBER 18TH, AND LOWER ONE ON DECEMBER 3RD. PLANTS GROW DAY AND NIGHT

dark, without the aid of the lights. We also installed," says Mr. Mojonnier, "sixteen 500 candlepower Mazda lamps in another part of the houses to test the relative merit of the two systems. While lettuce grows rapidly under the influence of the Mazda lamps it is inclined to be more spindling and light weight than that grown under the flaming arcs. We account in part for this by the considerable quantity of carbonic gas thrown from the arcs which is absent in the Mazda installation. This gas is a food for vegetation and is promptly taken up."

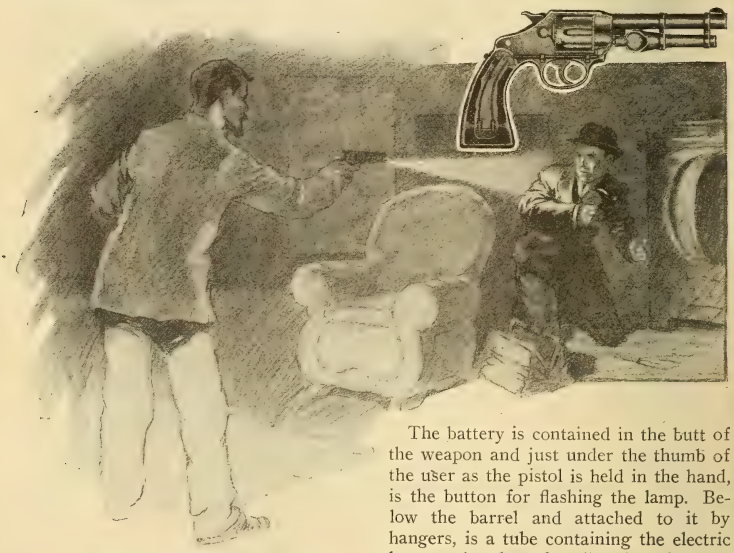
Referring to the other experiments, Mr. Rawson saves a week upon each of his three winter crops by the use of three ordinary street arc lamps hung over a house 370 by 33 feet. At Cornell the effects upon lettuce have been marked in all tests and the gains in maturity have been as much as two weeks.

Revealing Power of Light

It has been pointed out that not only the direction and intensity of light, but its color, must be considered in estimating its power to reveal fine details. Experiment shows that most persons are shortsighted for blue and violet light. When patterns are illuminated alternately with red, green and blue light, it is found that for ease of seeing minute details, blue and green light are preferable to green for short distances, but that at greater distances red light gives the best results.

Searchlight Attachment for Pistol

A lighting attachment for a pistol, consisting of a battery, electric lamp and a push button for controlling the light, has been patented by Clifford A. Lewis of Portland, Oregon.



THE PISTOL SEARCHLIGHT AND ITS EVIDENT ADVANTAGE

The battery is contained in the butt of the weapon and just under the thumb of the user as the pistol is held in the hand, is the button for flashing the lamp. Below the barrel and attached to it by hangers, is a tube containing the electric lamp and a lens for directing the rays of light.

The Tree of Light

With a tree and a carol, the Christmas spirit was revived in New York, and thousands of dwellers in that busy city where sentiment is supposed to lie dormant paused in their hustle and bustle

AN OUTDOOR CHRISTMAS TREE

to gaze at a thing of beauty that blazed against a background of park elms and tall buildings. It was the "tree of light," conceived in the mind of one who would provide cheer for those in whom the spirit of Christmas might need awakening and all the holiday week it gleamed in the darkened park.

The outdoor Christmas tree was a gift in every sense. The tree, a 60 foot balsam, was presented by the Adirondack Club, its transportation was donated by the railroad company, it was erected by an interested New Yorker, the wiring was a gift and the illumination was provided by the lighting company. Even the soloists, the choral societies, and the band gave their services free.

Late in the afternoon of Christmas Eve the "tree of light" was ready. Long before the appointed hour, Madison Square Park was thronged. People had come from all over the city and hundreds paused on their way home. There were shoppers with their arms filled with bundles and tired girls who had waited upon them, but they all stood patiently until the trumpeters sounded the fanfare from Parsifal. High at the top of the evergreen appeared the faint glow of a star, symbolical of the Star of Bethlehem of 2000 years ago. Slowly, as its message seemed borne upon the great throng, it gained in brilliancy until at last it burst forth in all its glory. For several minutes it ruled the darkness, and then the great tree seemed to spring to life as cluster after cluster of vari-colored globes shed their radiance from the branches.

At first the crowd stood in awed silence, then a burst of applause swept over the throng and as the choir burst into "Holy Night," the carol was taken up until a thousand voices were united with those of the singers on the platform. The program continued until one o'clock, when the lights were turned off. Each succeeding evening until New Year's, the tree gleamed from dusk till midnight.

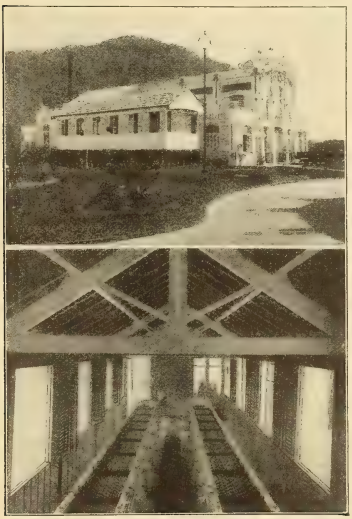
An Electro-Sanitation Plant in Brazil

A remarkable electro-sanitation plant has been in use in the city of Santos, Brazil, for about one year and is reported to be highly efficient and economical in operation. The building has a beautiful parklike surrounding and the power house which stands beside it is of an ornate architecture that resembles that of an amusement pavilion or exposition hall. In reality the sanitation plant is used to render the sewage of the city odorless and innocuous and it accomplishes its purpose so admirably that there is not the slightest nuisance involved in its operation. Although one half million gallons of raw sewage flow through this build-

ing daily in open troughs there is no odor perceptible. This is because of the instantaneous action of the electrolytic treatment which it receives, a process that deodorizes it instantly.

The operation is simple and the apparatus is not expensive to install. The main features are two uncovered troughs containing a series of electrodes, metal plates set on edge with about ¾ inch space between the anodes and cathodes. The proper wiring is connected from the sides of the troughs and the power is obtained from the adjacent power house.

An electric current of from two to three volts and from 700 to 800 amperes is maintained and the electrolysis not only



ELECTRO-SANITATION PLANT IN THE CITY OF SANTOS, BRAZIL

destroys all offensive odor but kills all disease germs, including the typhoid bacteria. The fertilizing properties of the liquid are not diminished by this process, which suggests an enormously profitable method of soil renewal.

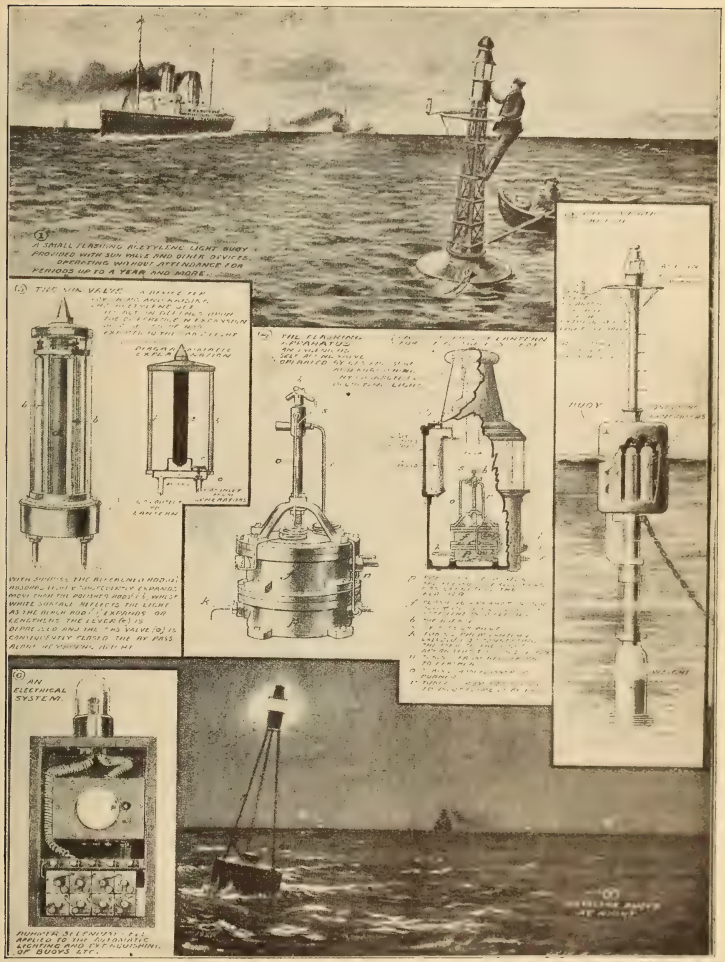
The cost of this plant was about $10,000 and the cost of operation is very slight, about $10 or less per million gallons treated. The only labor required is the inspection of the electrical apparatus and the cleaning of the plates by reversing the current a few times a day.

The Sun as Lightbuoy Tender

It is announced that a feature of the Panama Canal will be a number of acetylene lighted buoys marking the channel entrance, and these will be extinguished by the sun rising in the morning and automatically lighted when the sun goes down and darkness comes on.

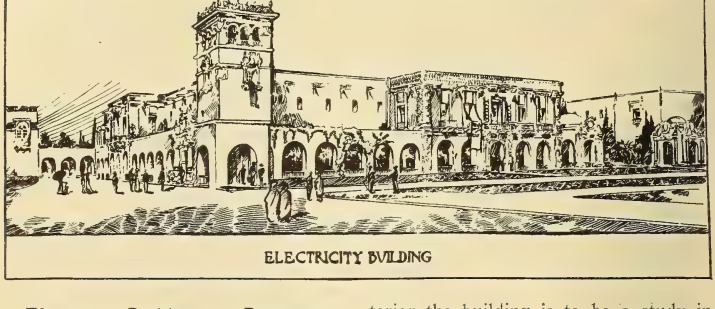
There are two systems proposed as shown in the illustration. One is that of Gustaf Dalen, the Swedish physicist. This is mechanical. Briefly, the warmth of the sun at dawn, falling on a rod which rests on a lever, expands that rod and so moves the lever which closes the gas valve. At night the rod, getting cooler, contracts, and so opens the valve and lets the gas pass, to be lit by a small jet always left burning. The rod can be adjusted according to the temperature conditions of any country.

The other system proposed, which is electrical, is that of Ernest Ruhmer. It was briefly described in the March 1912 issue of this magazine. It depends upon the substance selenium for its operation. Selenium has the property of being highly resistant to the flow of electric current when in the dark but becomes a good conductor under the influence of light. It is placed in a battery circuit in the buoy in such a manner that when the sun rises and strikes the selenium cell current flows through the circuit and operates an electro-magnetic device which turns off the gas. When darkness comes the selenium becomes highly resistant, cuts off the flow of current, and, the electro-magnet being released, the gas flows again and is lighted by a small permanent jet as in the case of the Dalen system.



By courtesy of the Illustrated London News

TWO TYPES OF ACETYLENE BUOYS PROPOSED TO MARK THE ENTRANCE TO THE PANAMA CANAL. BOTH ARE CONTROLLED BY THE LIGHT OF THE SUN—ONE BY AN ELECTRICAL DEVICE EMBODYING THE SELENIUM CELL



ELECTRICITY BUILDING

Electricity Building at Panama-California Exposition

With the expectation of its completion by the first of April, 1913, there is now being erected in Balboa Park, San Diego, Cal., the Electricity Building which is to be a part of the Panama-California exposition to be held there in 1915.

The structure is 250 by 300 feet, with balconies here and there and with towers which will be covered with vines by the time the exposition opens. The Spanish colonial style of architecture is followed, and, in fact, the building is modeled after the palace which Comte de Heras, a Spanish nobleman, erected for his own use in the City of Mexico in the seventeenth century.

It is planned to have the electrical building contain an exhibit which will give the history of the use of electricity from the beginning of its adaptation to man's use down to date. As far as possible every electrical discovery and every instrument or device which has been developed will be shown, the progress from the beginning being shown year by year in regular sequence. As a result of this every visitor to the building will obtain a comprehensive idea of the multifold uses to which man has put electricity.

The latest models of electric vehicles and boats will be shown, along with all kinds of electric motors, lighting, heating and medical apparatus. Upon the exterior the building is to be a study in lights at night and is expected to far surpass even the famous electric tower which was such a feature at the Pan-American Exposition in Buffalo in 1901.

Great progress is being made, it may be incidentally stated, in the preparations for the Panama-California Exposition at San Diego, which is to be distinct in every way from the world's fair to be held at San Francisco the same year. It is planned to open the gates on January 1st, 1915 and to keep the exposition going until the end of the year. This arrangement is possible by reason of the equable climate which San Diego enjoys.

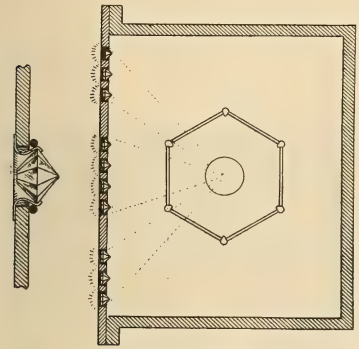
The Diamond Electric Sign

The "Diamond" electric sign is the latest French idea in this line and it uses letters made up of cut glass pieces cut like gems. When different colored light is thrown through the clear glass pieces, it makes them glow and sparkle like so many diamonds, and the effect is a striking one. The method of working is very clear. On the front board the cut glass gems are set in holes so as to make up the letters, clear glass being used in all cases so as to allow different colored light to pass.

Back of the board is a revolving drum with translucent glass faces, each face being of a different color, and inside the drum are incandescent lamps placed

along a row. When the drum revolves, the colors are thrown upon the glass gems in varied fashion, so that the gems appear to flash with a changing glow and thus produce a flaming effect which is very striking.

A small motor or clockwork rotates the drum, and the inventors point to the use of a low current for lighting the few lamps employed, so that a good sign can be had at a low cost for current, this being much less than where the letters are made up of lamps. If need be, the



THE DIAMOND ELECTRIC SIGN

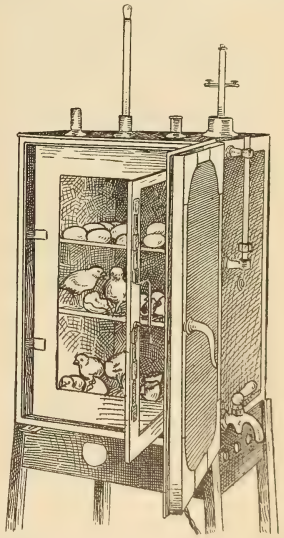
sign can be put out and lighted at intervals, by the revolving device. Even in daytime the sun strikes on the diamond faces and gives a very brilliant effect.

Electric Incubator and Brooder

An electric incubator and brooder which is finding much favor in Germany is described in *Mitteilungen* the publication of the Berliner Elekricitäts-Werke. With this incubator it is possible to approach very closely the results of natural incubation, and thus reach a very favorable result (80 per cent) in the hatching of chickens from artificially incubated eggs.

The heat produced by an electric current is made in this apparatus to regulate itself to a fraction of a degree. In this way a pratically uniform hatching temperature is maintained, which is seldom reached by other artificial methods. This incubator requires no attention beyond the daily turning and airing of the eggs. As a consequence of the automatic heat regulation by the shutting off of the current when the desired temperature is attained, the consumption of electricity is reduced to a minimum, and since the energy is calculated according to power and heating charges, the expense is very small.

The brooder, like the incubator, is built on the principle of making the most economical use of the heat of the current, thereby keeping down the cost of operation. In combination with an electric

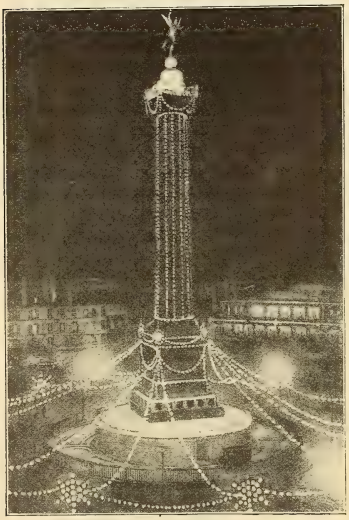


BROODER AND INCUBATOR BUILT TO MAKE THE MOST ECONOMICAL USE OF HEAT

lamp the brooder keeps the chickens comfortable and warm and consequently a very large per cent of those hatched can be reared, whether in winter or spring.

Lighting the Bastile Column

The 14th of July is the French independence day, and corresponds in idea with our own Fourth of July. This date commemorates the taking of the Bastile

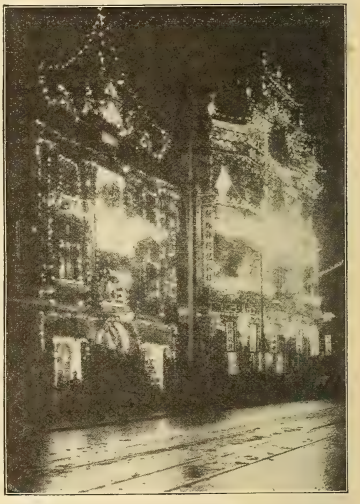


THE FAMOUS BASTILE COLUMN AT NIGHT

during the Revolution and it is also a time of general merrymaking in the streets of Paris, especially at night when the open air balls in the public squares and the illuminations all over town make an attractive scene. Electric illumination naturally heightens the effect, such as the lighting of the famous Bastile column which the photograph shows. On the top of the column the figure of Victory, which appears to be small, but is in reality of colossal size, is brilliantly lighted up by the lamps placed around the platform and the decoration is made up of long rows of lamps running from top to bottom, together with numerous garlands. On the whole this is one of the most interesting examples of electric illumination to be seen in the city.

Electric Advertising in Shanghai

Shanghai, the commercial metropolis of China, has seen such changes in the few months which have intervened since the conservative Chinese empire was changed into a modern republic that it is difficult to realize what the city was a year ago. Space forbids a description of these changes, and indeed this page is not the fitting vehicle therefor, but all those interested in electrical science and its application to modern commercial needs will be interested to learn that John Chinaman, emerging from his Rip Van Winkle slumbers, bids fair to rank with,



VIEW IN SHANGHAI—THE CHINESE IDEA OF ILLUMINATED BUILDING FRONTS

if not excel, the most up-to-date nations of the world in connection with the adaptation of electricity to this form of advertising.

Shanghai has a foreign population of over 13,000. In the international and French Settlements there are 300,000 Chinese, and in the Chinese city itself about 540,000. The total trade of the port for the year 1911 amounted to $153,000,000 in gold, and thus it will be readily understood what the possibilities are for the retail trader.

The Nanking Road, leading from the business section to the residential district, is the principal foreign thoroughfare. For eighteen out of the 24 hours it is thronged with pedestrians—of all nationalities, but principally Chinese—and vehicular traffic. All the principal shops are congregated there, among which are the silversmiths' stores. Three of these places have recently been rebuilt, and have been fitted up in the most elegant and up-to-date manner in order to display their wares to the best advantage.

Not content with internal decoration, the exteriors have been decked, regardless of expense, in a manner which would appear strange to people of other lands, as can be judged from the accompanying picture.

The photograph here reproduced shows the premises of two dealers, in another part of the same road, illuminated. The more pretentious of the two has 2,000 sixteen candlepower electric lights, the other 1,500. These are worked in among the fantastic decorations, some of them of an allegorical nature and operated by clockwork.

Questioned as to whether the results warranted such an expenditure, the enterprising proprietor of one of the stores remarked, "Maskee how much he cost. Can catchee plenty tlade so fashion."

Needless to say, the nightly display attracts crowds of Celestials, who stand open mouthed and dumb watching the free show, obstructing the traffic, and affording the pickpockets an easy mode of livelihood.

It is stated that the illuminations will be continued indefinitely although the cost is heavy even for a single night.

Troubleman's Portable Searchlight

A portable light that will enable the troubleman to examine the wires on a transmission line at night means quicker location of trouble.

The portable searchlight here shown is fed from a tank with gas at 250 pounds pressure, the tank being carried on the back of the troubleman. The lamp will burn for 70 hours on one charge of gas.

It is possible with this light to see clearly the wires at the top of the highest poles. It furnishes sufficient light from the

TROUBLEMAN WITH A SEARCHLIGHT

ground for the re-fusing of transformers and the replacing and repairing of lines at once, no matter how dark and stormy the night, with the minimum amount of danger to the man doing the work. As a very large percentage of line troubles occur at night the value of this outfit can be readily appreciated.

Mount Wilson Observatory

Electricity is one of the most important auxiliaries in the work of the modern astronomer and the range of its applications in this field is nothing less than surprising. The Mount Wilson Solar Observatory, in southern California, is one of the most noted installations of this kind in the world, and the accompanying photographs show two or three applications of special interest. The largest telescope on Mt. Wilson is a 60 inch reflector, and when this was hauled up the mountain in parts a few years ago a gasoline-electric truck had to be impressed into service and an old, ten mile trail 30 inches wide rebuilt into a ten foot roadway.

The observatory is planning to erect a 100 inch telescope on the mountain, and this is to be the largest glass of its kind in the world. Recently it was discovered that the glass being ground for this purpose in the Pasadena laboratory of the institution was not flawless and many months of hard and delicate work came to naught. Arrangements have been made for the manufacture of a new mirror, and when the telescope is completed and set up in its new home on the summit of the mountain, it will be capable of being turned at many angles by small motors responsive to the hand of the observer. The great tube's range of motion is shown in the accompanying view of a model frame which the mechanicians of the observatory staff have prepared in studying the possible mountings of the instrument.

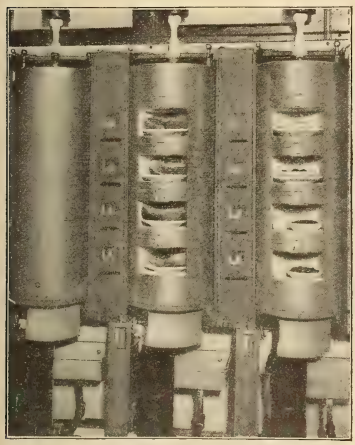
The observatory maintains an important laboratory in the city of Pasadena where exhaustive experiments are carried on in the comparison of phenomena noted in the heavens with the results of spectroscopic and other observations made within doors. The accompanying view shows one of the most powerful electro-magnets in the world in use in this laboratory, the magnet being built in two parts and water cooled. When fully excited the coils of this magnet absorb about sixteen kilowatts or about 20 horsepower of electrical energy. By its use many of the conditions of the solar magnetic field have been simulated.

TWO VIEWS OF A MODEL OF A 100 INCH TELESCOPE MOUNTING.—MOUNT WILSON OBSERVATORY. IN THE CENTER IS A GIANT ELECTRO-MAGNET IN THE OBSERVATORY LABORATORY, FOR STUDY RELATING TO THE SOLAR MAGNETIC FIELD

Money-in-the-Slot Restaurant

Mr. Edison predicts automatic or money-in-the-slot stores and the "Automat Lunch" at 1557-63 Broadway, New York, which now feeds 10,000 people daily, goes far towards verifying his prophetic vision.

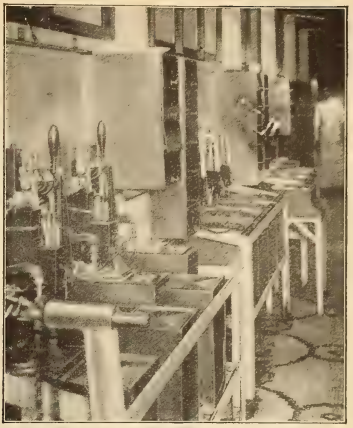
Passing under a big electric sign and through a doorway surrounded by a $6,000 stained glass window, mechanical coin devices in connection with drums and enclosures that contain foods and drinks to suit any palate are found. Hunger



COOLING CABINET FOR FOOD PREPARED AND READY TO SERVE

may be appeased by inserting a coin of proper value and either turning a knob or pulling a lever. Through glass windows the customer can inspect the food he is to pay for.

The drums containing the ice cream are kept chilled by a surrounding jacket through which cold brine circulates. Hot machines circulate hot water through a jacket. Ten hot and cold liquid machines containing orders of tea, coffee, milk, buttermilk, etc., are operated by electric



HOT AND COLD LIQUID MACHINE OPERATED ON THE COIN-IN-THE-SLOT PRINCIPLE

pumps which measure the proper amount at each helping. Even the cream is poured into the cup before the coffee.

Three motor driven ice machines in the

REAR OF THE FOOD CABINET FROM WHICH THE DISHES COME FORTH WHEN A COIN IS DROPPED IN THE SLOT

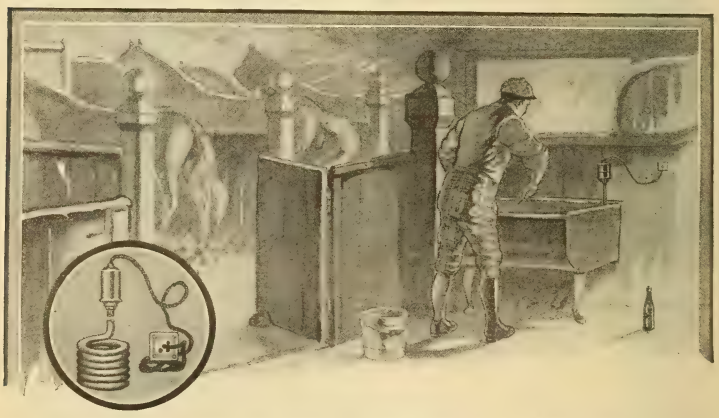
basement constitute the refrigerating plant and two electrically operated dish washing machines on the top floor take care of the soiled dishes sent up by an electric conveyor. Tungsten lamps are used for lighting and 22 electric fans provide ventilation.

Although the tile floor, ornamental columns and glistening machines are inviting, there are those who are still a bit shy and these may find beneath the main floor a room where 240 people may be served in the old "Order, please" way.

Warm Meals for the Horse

In the cold, windy days of winter, the horse is called upon to face the sleet and storm, and this faithful beast appreciates a warm supper after such a day's work as much as does his driver.

In the preparation of this feed the electric heater comes into convenient service as most livery and boarding stables are lighted by electricity. The American heater suitable for this purpose consists of a metal coil within which is contained the heater wire. The coil may be set into a pail or trough of feed and water and a connection by a length of flexible cord and a plug made with the nearest light outlet. In two or three minutes' time the feed is warm and is far better for the horse than an ice cold supper.



THE ELECTRIC HEATER IS A VALUABLE ADDITION TO THE STABLE EQUIPMENT

Automatic Compasses for Ships

There is a form of compass that automatically registers the route followed by a ship. It is a matter of practical experience in navigation that the steersman often varies from the course set for him in advance, and sometimes the final effects of these variations may become serious. The Heit compass preserves a record of all the departures made by the ship from the set course from one end of the voyage to the other, and this record may be consulted at any time. The compass is connected with an electric apparatus in such a way that once every minute the angle made by the ship's course with the magnetic meridian is recorded by means of an electric contact.

The records are made on a moving roll of paper, whose motion is so timed that the hour and minute of the contact are

automatically indicated. Thus the ship's captain has continually before his eyes a chart of the course he has traversed.

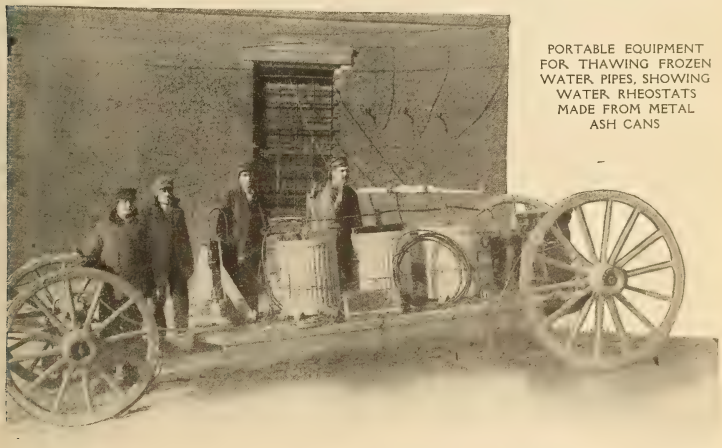
Economical Lighting in a Pumping Plant

An inexpensive method of providing electric lighting is employed in a large pumping station in the East. The plant contains two steam driven pumps of 11,000,000 gallons combined daily capacity, but no small engines. To avoid the inconvenience of installing the latter a fifteen inch Pelton water wheel was purchased and direct coupled to a small dynamo. The water wheel is operated on about 100 pounds pressure per square inch taken from the pumping mains and after the water passes through the wheel it is returned to the station well so that none is wasted. The city reservoir provides sufficient head to run the unit even when the main pumping engines are shut down.

About ninety 40 watt tantalum incandescent lamps are supplied from the unit, the full load each night being about 75 lamps. The equipment requires practically no attention, and the cost of operation is trifling in comparison with the expense of purchasing current or of running and maintaining a steam or oil engine set for illumination service.

Thawing Frozen Water Pipes

A portable emergency electrical equipment for thawing out frozen water pipes was made at Fort Leavenworth Army Post last winter and used successfully all winter. After several frozen pipes had to be uncovered the apparatus shown mounted upon the wagon was used. There are two transformers which were connected to the nearest high voltage pole line through fuses. Current through the piping, which was connected to the 110 volt side of the transformers, was regulated by water rheostats made from large metal ash cans.



PORTABLE EQUIPMENT FOR THAWING FROZEN WATER PIPES, SHOWING WATER RHEOSTATS MADE FROM METAL ASH CANS

The most stubborn case in 3¼ inch pipes required thirteen minutes and 127 amperes to thaw out. A two inch pipe took 34 minutes and 327 amperes. In all cases the pipes became smoking hot.

From Ingot to Wire

By H. Bedford-Jones

Americans have learned the lesson that many heads are better than one. Instead of one man putting all his energy into a whole factory system, many men concentrate each on his own department. All important questions now-a-days are settled by committees—not by single individuals.

Sixty years ago there was a canal at Worcester, Mass. The railroad came and the canal went out of business. But it is still of use in the world. Its bed serves as a dipping tank for the American Steel & Wire Company; its water serves to cool the steel and iron of the mills. Each night the mill workers go home along what was once the towpath. Such is the evolution of business in theory and practice. One-man-power would never have harnessed that canal; it would have been too busy harnessing details.

The one hundred and two acres of the Worcester mills in actual use are under various heads. Each of the north, central and south works is a mammoth industry in itself. I had seen cable works and steel mills before, but when I left the general offices and started out to inspect things, I was amazed. Here I encountered the primeval industry, the giant at the bottom of the refined factories higher up in the scale. Here I found men who really worked by the sweat of their brows, and added to it all the other sources of perspiration possible. In the annealing room, standing on the floor gratings, watching the men shifting huge cranes of metal from baths of cleansing acid into annealers and heating ovens, my thoughts went back to Dante. But they did not stop there. They went a good deal farther back than Dante before I got through.

There is a tremendous fascination about copper, the shimmering red-gold metal of many hues. The workmen felt it just as much as I did. I stood looking at the piles of copper wire fresh from the annealers, and the foreman came over holding up a coil admiringly.

"Ain't she a peach, eh?" he exclaimed. "You ought to see her when the ovens are opened!"

I did, and it certainly was beautiful. Outside, in the yard, were row upon row, car upon car, of dull gray coils from the rod mill. These went into the acid baths and came out from the washing gleaming rose-pink. They went into the annealers and came out gold-red, more beautiful than gold—"Mary Garden copper" we called it. It was quite a compliment to Mary, not to the copper.

Softened and rendered ductile by the annealing, the coils of wire, both steel and copper, go to the drawing rooms. Here they are drawn smaller and smaller, to go back time after time to the annealing rooms. Rigid specifications demand rigid care and supervision. If the wire is drawn to a greater tension than its ductile capacity will permit it is ruined. Often it is annealed half a dozen times in process, to remove the internal strains produced by drawing.

The beauty of copper wire is by no means an end in itself. It is a means to an end. In the annealing process unless properly manipulated, scale is very apt to form and any oxidization would seriously impair the efficacy of the future product. The metal, while at the high temperature necessary for proper annealing, if kept from all contact with the air will come out as bright as if just polished.

The wire goes to the drawing rooms in various sizes, and the exact specifications must be known beforehand. This latter statement applies all through the whole establishment. The exact use and speci-

fications of the future completed product are known before it goes to the factory. This is borne in mind through every process and for this reason the Worcester plant specializes in special products.

drum. Speech is impossible here. The roaring of the machinery and the dull rumble of whirring wheels is hardly observable until you attempt to talk. Then you notice it. And what a variety of

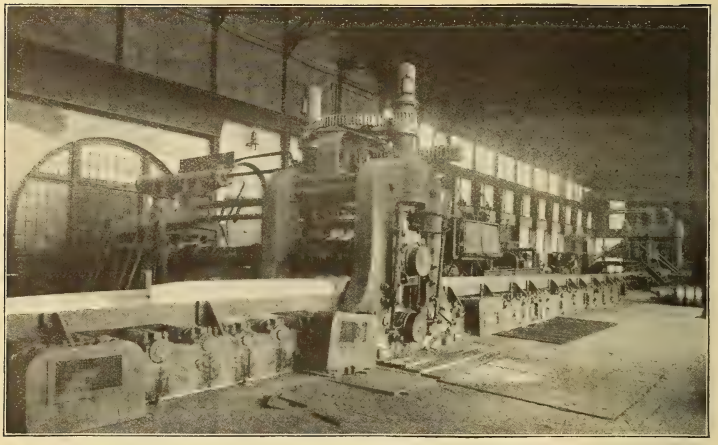
THE TITANIC FINGER FOLLOWS US WITH UNERRING SPEED, BEARING A WHITE-HOT INGOT

THE LABORATORIES ARE ESSENTIAL FEATURES OF THE PLANT AND ARE OF NO LITTLE INTEREST TO THE VISITOR

A coil of wire may be given a few drafts, or it may be given many, both making the same size in the end; but the physical characteristics of the two finished wires will be entirely dissimilar.

I followed on after the coils, each one growing longer and finer, from drum to

noises there are in different parts of the plant! Stepping out of the blooming mill into the engine room, you are tempted to think that all noise has been left behind. Then you find that instead of the crash and plunge of tons of white-hot metal there is a simple, silent burr of



THE BEGINNING OF A WIRE—RECEIVING SIDE OF A BLOOMING MILL

engines here which renders all other sound mute. Fortunately, the wire process needed but little oral explanation. Smaller and smaller grew the wire, longer and longer, until at last it came to the diamond dies. And before my eyes was worked a miracle.

Three-fifths of a mile of copper wire was fed into the machine. The wire traveled at the rate of 500 feet a minute, but was rolled up at the end over five times as fast as it was unrolled at the start. In fact, the three-fifths mile became three and one-tenth miles, going through nine drafts in this single machine, from roll to roll, in less than half an hour. Its diameter began with .0641 inch and finished at .0285 inch. Three thousand feet were made into 16,000 feet.

The diamond centers of these dies are marvelous pieces of microscopic work which must be able to stand the steady rush of heavy work and the wear and jar of constantly passing wire, while remaining absolutely perfect. They wear out in time, of course; as the holes in the diamonds become larger, the die is passed on to the next larger wire and replaced by a new one made in the shops. Each diamond center is bored, then firmly bedded in nickel, which in turn is centered in the brass die. Then the microscopic hole is finally bored and rounded, to the size of a wire that is almost a copper hair.

This is a Titan among factories. There is far more in its bounds, it seems to the visitor, than in other plants of equal acreage. As a steel and copper plant it is enormous. As a wire producer it is enormous. As a spring mill, a cable works, an insulating plant, a railroad system—in each detail it is enormous. In the south works alone there are nineteen miles of railroad tracks. The amount of material on hand must run up into the millions at each inventory; its monetary value is probably far greater than most people would suppose, owing to the great costliness of the materials—rubber, copper, silk and all the rest.

But let it not be imagined that here is copper only. Copper wire plays but a very small part in the whole general scheme of things. The making of steel

THERE IS A TREMENDOUS FASCINATION ABOUT COPPER, THE SHIMMERING RED-GOLD METAL OF MANY HUES

is always a mammoth project; here, it is a humanly interesting one. As one of my guides pointed out, it is entirely analagous to human life itself. From the scrap heap it goes through various formative processes, is turned out to perform its work in the world, and in course of time returns to the scrap heap. And this scrap heap is a wonder.

As I stood and gazed up at it, while the overhead crane and the giant electro-magnet carried tons of metal from place to place, I could pick out nearly everything from swords to ploughshares in the pile before me. Here were parts of battleship armor, cog-wheels from shops and machines, farm machinery, garden tools, automobile scrap, car couplers—everything which is manufactured from certain grades of iron comes back here to the scrap heap from the Hebraic hands of the city. This is a morgue of dead ambitions, a charnel house of genius. All of these scraps, from big to little, were products of human brains and energies, once vital and in their turn energizing the world.

But the electro-magnet takes hold on them, their individuality gone, and shifts them on to cars for another reincarnation, tons of them at a time. This giant magnet works like nothing so much as a dry sponge picking up drops of water. A man could do it with his fingers, a drop at a time; but as the sponge is pressed down the water runs to it and all is over. Tons of this scrap were lifted by the single magnet; as it went up and over the ground the iron scraps ran to it, stood on end to greet it, and were finally carried on and away by it until they were absorbed in the general mass.

The steel furnaces are terrific—great masses of metal and fire brick lost in the dull steel rafters above, surrounded by smoke whorls and smudge in which move the figures of puny men, impotent yet all-potent, handling everything by a switch here, a lever there. The coruscating steel is poured into the ingot moulds, car after car of them which move on in endless procession. One of these furnaces is significant. It is electric—it does away with fuel. Rather, it makes

steel out of the energy of falling water, for it is run by hydro-electric current, the three electrodes heating and purifying all. In days to come the electric furnace may do away with the fuel problem, in factory and in home, and we of today are witnessing the beginnings of a new era, over the horizon of which we can as yet but dimly see.

But the ingots are cooling, and we must go on. Stripped of the moulds, each ingot weighs two tons or more. The cars take them into the blooming mill, and here the ingots are carried about, tossed and played with, like the jackstraws of a child. All about us are white hot furnace pits. Overhead travel giant cranes, between each a prehensile finger tip that folds up into itself uncannily, grotesquely. Very carefully but with exceeding speed the long finger shoots down and grips a red hot two-ton ingot. Over us it whirls and then down into a glowing pit where the ingot is dropped for greater heating. Then the finger delicately cools its nails in water before lifting more, so we go upstairs to watch the next operation.

Before we can reach the top the titanic finger follows us with unerring speed, bearing a white hot ingot. This it deposits in a holder, and the play of the gods is begun. The mighty mass of steel is tossed about hither and thither on a line of rollers and upshooting hands that grip and whirl it, until it travels down to us and enters the presses.

These are controlled by four men on a platform above. The glowing ingot is pulled forward and back through the rolls, and we seek a reason for the action. Half a dozen times this is repeated, the ingot undergoing no appreciable change; but suddenly we notice that the metal is longer, thinner. Then the rolls clamp down and as the white hot end appears one can see it crumple up and come through, half its former size.

The metal resists this, twisting, quivering and curling in a frantic effort to get away from those unfaltering rolls and omnipresent hands of steel. But those hands show no mercy, the rolls bear it ever onward, and soon the luminant metal has become a giant's jackstraw which is tossed around and whirled back and forth until it is drawn into a seemingly thin rail of red hot steel.

Then down the trackway to the lesser rolls, where it is finally cut up into four-foot lengths called billets. These lengths are pushed on to the cars and loaded mechanically—and we emerge into the blessed free air once more, thanking fate that it is not our lot to lose the blue sky and the winds of heaven for the dim rafters of the blooming mill.

The steel billets are taken to the rod mills and reheated and rerolled. Now one begins to see that wire comprises much more than a mere strand of metal. It may be of all shapes, all sizes. Wire is shipped out to be brass coated and rolled into tubular steel for beds; other wire is shaped, sectionally, like a star. This goes to watch and clock makers, is cut off into narrow slices, and these become the cog-wheels in our cheap timepieces. Wire is not all cylindrical by any means. Trolley wire, for instance, is grooved in various ways and shapes; and there are turned out over 500 different shapes of wire, used for every purpose under heaven.

So onward goes the stubby billet of steel. As the size of the rod or wire decreases the speed at which it travels increases, until in the end the four-foot billet has become a quarter of an inch thick and a quarter mile long. Then it is coiled, still red hot, over drums and passed on to the next room, where it is loaded on cars to be held until the wire mills are ready for it.

But within my given limits of space it is impossible to amply describe this immense place. It has so many ramifications, there are so many special products and special processes employed, that this entire issue could be filled with a mere generalized description of the place.

One of the interesting features is the

utilization of the by-products. In various European countries hot slag is blown into thin threads of cottony material, and this is later woven into a cloth-like substance which being a non-conductor of heat is used for many purposes. But here the hot slag is thrown into cold water, and the resultant explosion leaves it in the form of a powder which is ground and used extensively in the making of cement. Another by-product is sulphate of iron, of which thousands of tons a year are sent out. The various acid cleaning solutions become charged with this, and it is carefully saved, being used as a weed exterminator and water purifier.

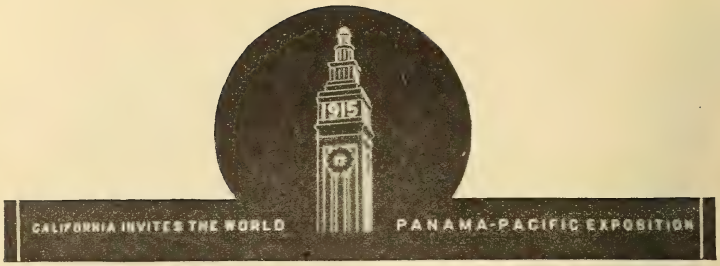
The insulation of the wires and cables is extremely interesting. In other articles I have described the stranding of a cable and the braid insulation, placed on the wire by braiding machines and thousands of flying shuttles. Besides this, the rubber insulation is also made here at Worcester. There are two methods of doing this.

The rubber is sent through the rollers, or calenders, as they are called, and comes out in thin strips of rubber sheeting. This is then wrapped about the wire by means of special machines, which leaves a thin seam along the entire length. Later, the vulcanizing process, which develops the characteristics of the rubber and gives it life, does to the insulated wire essentially what the heating process does to steel. The second method is to press the rubber tightly about the wire, just as lead is pressed about a cable, in a complete sheathing. The completed wire of the first process shows no trace of a seam after the vulcanizing, which effectually welds the whole.

A very elaborate equipment is in use for tinning and galvanizing wire. Copper conductors are often tinned, and telegraph wire is nearly always galvanized. The absolute perfection demanded by trade specifications makes a corresponding perfection necessary in the making. The principle of this process is the passing a wire through an acid tank which cleanses it, then through a vat to wash off the acid, then through a flux and lastly into the molten tin or zinc. It is easy to make the metal adhere to the surface as a whole, but it is hard to cover the wire with a uniform thickness of bright metal which will neither crack nor peel, and the resultant machinery and operations are ingenious and interesting in the extreme.

Naturally the laboratories are essential features of the plant, and are of no little interest to the visitor. Here small models and samples of all kinds may be made, which could not possibly be turned out of the huge shop machines. For example, I saw a few inches of a sample sub-ocean cable—strand after strand of steel wires and saturated insulations, enclosing the all-essential core in its heart; and beside this lay a bit of the first Atlantic cable—primitive, if you like, but none the less an epoch maker in the world's progress.

This is the American Steel & Wire Company, in an infinitesimal degree. There are many places about it I have not visited, there were mills and shops I had not even time to go through, or the space in which to describe them. And all this is the labor of men in the mass. Every trifling detail of the whole place has been worked out by some unnamed man or men, and involves a dozen other more trifling details which had first to be worked out. Component work is marvellous in itself; individual work is marvellous as showing the strength of an individual. But the individual work, however great or far reaching, must surround itself with other individuals and become mass work if it is to meet with success. That is why great men surround themselves with greater men. That is why American business will stand in the forefront of world progress for ages to come.



THE GREAT WELCOME SIGN ON THE UNION FERRY BUILDING. IT IS 600 FEET FROM END TO END. THE TOWER ABOVE CONTAINS OVER 4,000 LAMPS

Construction of the 1915 Exposition Begun

By RUSH KIRBY

That group of enterprising citizens known as the Exposition Company has carried the development of the Panama-Pacific Exposition to such a point that general preparedness is an accomplishment of the past. Actual construction has begun. In fact, the first building, one of the minor affairs of the great structures contemplated, is now occupied by exposition organizations such as the Police Department, Commander of the Guards, Emergency Hospital, etc. Daily, scenes of construction are now witnessed which effectively dispell all fear of the undertaking becoming a sluggish enterprise, and weekly, one might almost say, foreign envoys arrive and select sites for pavilions and exhibits. Experts say San Francisco is a whole year ahead of previous expositions in preparation. General plans for fourteen principal exhibit palaces are ready. The contract is let for grading the site of Machinery Hall, the largest edifice to be constructed, and bids for its construction are called for. The contracts for grading the railway yards and for the improvement of Fulton Basin the contemplated yacht harbor—are also let. Twenty-two foreign nations have accepted invitation to participate, while five have their flags flying over sites chosen and dedicated for their edifices. Nineteen states likewise have their colors flying over chosen locations. Eight hundred leading exhibitors of the world have applied for space, which is some seven hundred over those of similar periods. Two thousand concessions have filed application—something unprecedented. And all this before active campaign has begun.

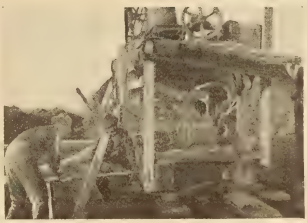
Persons not directly connected with the exposition work see but little of the vast amount of activity engaged in by the Exposition Company. It is a casual stroll over the great area about to blossom into a fairyland that opens the eyes of the visitor. Indeed, the evidences of unequaled spirit and progress are not only convincing but their magnitude is so impressive that one enthusiastically wishes San Francisco God speed and good luck and experiences a yearning to join in. And through it all again, as the eye sweeps over the scene, there is observed stretching across the sky line, extending from the forest of houses on the hills, over the site and down to the water's edge, a line of tall poles whose cross-arms bear power transmission wires, for, be it known, the services of electricity have become imperative and today this line conveys the first electric power to be employed on the fair grounds.

BREAKING GROUND FOR MACHINERY HALL, THE LARGEST BUILDING TO BE ERECTED AT THE 1915 EXPOSITION. THE STRUCTURE WILL EXTEND FROM THE CENTER OF THE MASS OF PEOPLE ALMOST TO THE WATER'S EDGE. IT WILL CONTAIN 8,000,000 FEET OF LUMBER, ENOUGH TO FLOOR 200 ACRES, OR 64 CITY BLOCKS. A PERSON WILL TRAVEL A DISTANCE OF ONE MILE IN WALKING AROUND IT, AND TWO MILES OF DECORATIVE CORNICES WILL BE USED IN ORNAMENTING IT

BRINGING THE FIRST ELECTRIC CURRENT INTO THE FAIR GROUNDS

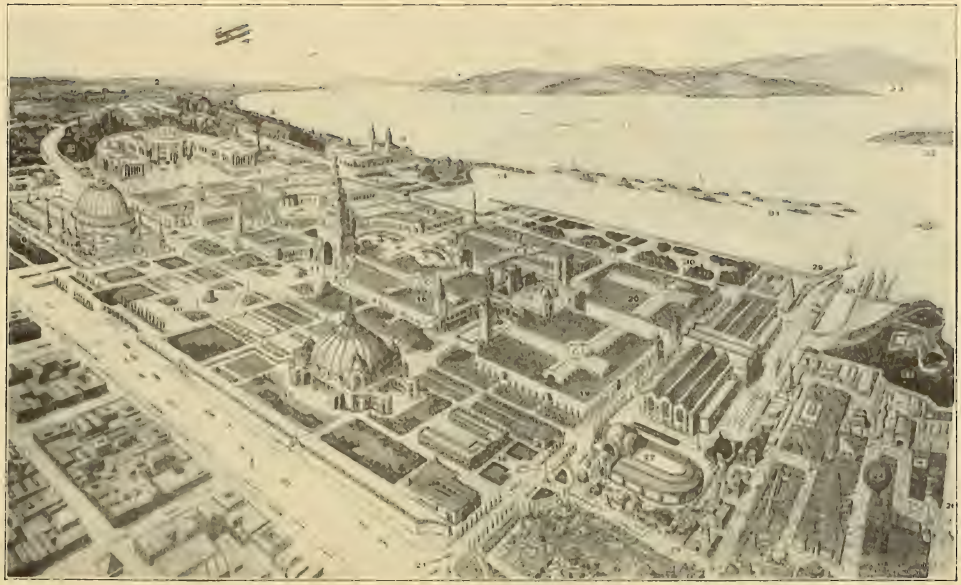
FIRST MOTOR TO OPERATE ON THE GROUNDS. PUMP HOUSE ON A FILL NEAR THE WATER'S EDGE

A trivial event may seem the installation of this transmission line with its transformers and motors, yet when, on Thursday evening, November 14, 1912, as the setting sun slowly sank out in the great sea of red, the electrician at the pumphouse down on the fill near the shoreline "plugged in the juice" on a ten horsepower motor and started the whir and hum so familiar to mortals who frequent the electrical world, he put into operation the forerunner of the vast amount of that mystic energy that will ere long be raising beam to pinnacle, recording the vigil of the nightwatch and toiling day by day on a most ambitious undertaking.



MOTOR OPERATED CONCRETE MIXER BEGINNING THE SEWER WORK

Passing at twilight into the heart of the city and down to the foot of Market Street where the great Union Ferry Building rears its tall tower, we observe that not only does the traveler just entering the portals of the city, but the busy San Franciscan himself pause and gaze upward to watch the tall pinnacle flash into light as the hours of illumination are begun. It is then that the eyes fall upon the dazzling white numerals above the great clock and cause the ob-



Copyrighted by the Souvenir Publishing Co., San Francisco

BIRDSEYE VIEW OF THE PANAMA-PACIFIC INTERNATIONAL EXPOSITION

To be held in San Francisco, California, February 20th to December 4th, 1915.—Drawn from the official diagrams and plans

1—Foreign Governments Building. 2—Live Stock Exhibit. 3—U. S. Government Building. 4—State Buildings. 5—Fine Arts Building. 6—Horticulture Building. 7—Education Building. 8—Food Products Building. 9—California Counties Building. 10—Grand Main Entrance. 11—Grand Central Tower. 12—Liberal Arts Building. 13—Agriculture Building. 14—Yacht Harbor. 15—Festival Hall. 16—Manufactures Building. 17—Transportation Building. 18—P. F. I. L. Service Building. 19—Varied Industries Building. 20—Mining and Metallurgy Building. 21—Fillmore St. Entrance. 22—Motor Transportation Building. 23—Machinery Building. 24—Joy City. 25 Acres of Concessions. 25—The Joy Way; Zig-Zag Street through the Concessions. 26—Van Ness Ave. Entrance. 27—Fort Mason. 28—Transport Docks. 29—Ferry Boat Landing. 30—Grand Marine View Esplanade. 31—Warship Anchorage. 32—Alcatraz Is. U. S. Military Prison. 33—Mt. Tamalpais—The Most Scenic One Day R. R. Trip in the World. 34—Fort Winfield Scott guarding the Golden Gate. 35—Presidio U. S. Military Reservation. a—West Court of Four Seasons. b—Central Grand Court. c—Festival East Court.

server to forget the world and its cares and behold visions of the coming wonders of the exposition.

The illumination of the tower on the ferry building, combined with that of the structural steel invitation at its base extending for some 600 feet along the roof and built of eight foot letters, is part of an extensive plan to give publicity to the coming exposition, though this building throughout is controlled solely by the State Harbor Commission. In this decorative achievement is seen vividly the powerful and far reaching effect electricity has in the art of exploitation. Some 4200 eight and sixteen candlepower lamps are set in the lines of the tower alone. The numerals comprising the "1915," placed both on the land and bay sides, burn in tungsten white and stand out beautifully, showing well the advantage of tungsten over carbon in lamp filaments. Only 60 watt lamps were used here. The hour-points on the dial of the huge clock are set with sixteen candlepower carbon ruby lamps. The voltage maintained throughout the system is 120.

The great sign conveying California's invitation to the world faces the bay and all the transbay region wherein lie the cities of Oakland, Berkeley, Alameda and Richmond, from which direction travelers come and go in their visits to the city. On clear nights, this invitation and tower, when illuminated, can be observed 20 to 50 miles away, though the letters become indistinguishable at about 20. The entire combination undoubtedly constitutes the largest steel electric sign in the world.

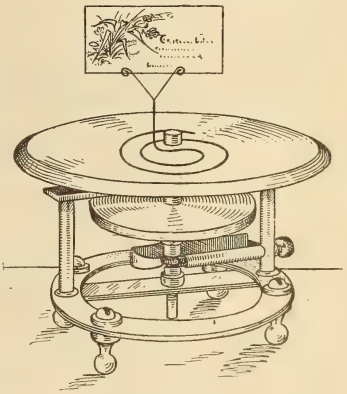
Radiation from Potassium

It is possible, judging from the experiments of Mons. E. Henriot, that potassium should be added to the short list of substances known to possess the property of radio-activity. The observed amount of radiation is small, but Mons. Henriot thinks that it is not due to the presence of traces of some of the recognized radio-active substances, but must arise from the potassium itself or from some unknown body associated with it.

The Rotating Spiral

A curious movement can be obtained by the use of a small rotating bar magnet. The end of the small magnet runs up for a short distance above a table and below is a clockwork or other device which rotates the magnet as a shaft. A small motor can also be used. On the table is placed a spiral of iron wire and this is kept drawn against the magnet, but as the magnet revolves, the spiral also sets up a movement which acts about like a gear movement between these two pieces, since the magnet always adheres to the spiral so as to keep on driving it.

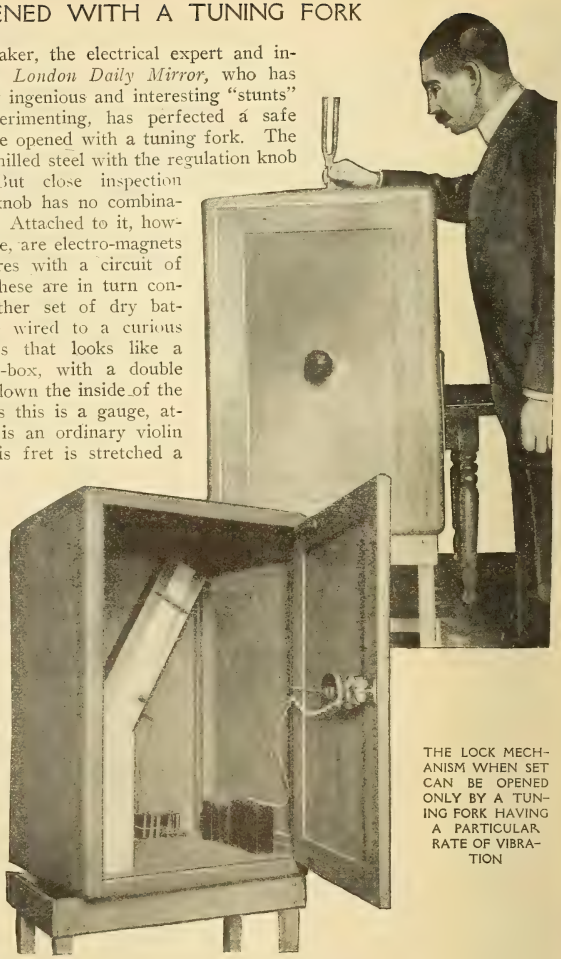
When at the end of the spiral, the magnet does not let go, but passes around to the outside of the wire, so that the motion keeps up without stopping as long as the magnet revolves. It is an easy matter to curve the end of the wire so as to make it take an upright position, and a card can be mounted on it. The card now keeps up a continual motion and will serve very well for use in a show window owing to the curious effect it produces.



ROTATING SPIRAL

SAFE OPENED WITH A TUNING FORK

Mr. Thorne Baker, the electrical expert and investigator of the *London Daily Mirror,* who has done some highly ingenious and interesting "stunts" in electrical experimenting, has perfected a safe which can only be opened with a tuning fork. The safe is made of chilled steel with the regulation knob on the door. But close inspection shows that this knob has no combination or timelock. Attached to it, however, on the inside, are electro-magnets connected by wires with a circuit of dry batteries. These are in turn connected with another set of dry batteries, which are wired to a curious looking apparatus that looks like a carpenter's mitre-box, with a double row of numbers down the inside of the channel. Across this is a gauge, attached to which is an ordinary violin bridge. Over this fret is stretched a music wire of metal, drawn taut to a binding post and passing through this to form a coil below it and outside the tuning box and thence down into to the dry batteries.



THE LOCK MECHANISM WHEN SET CAN BE OPENED ONLY BY A TUNING FORK HAVING A PARTICULAR RATE OF VIBRATION

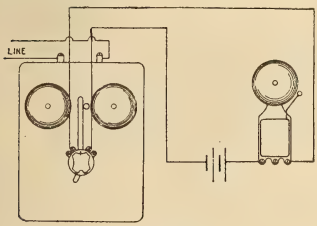
This mitre box is really a musical scale, set by numbers so that the tone can be gauged up or down by two's as may be desired, to meet the needs of a new combination, or a new tuning fork, if it is desired to thus change the combination or opening note. The music wire, which may be a guitar, banjo or violin string, is selected and gauged to synchronize with the tuning fork used. When the tuning fork is struck and placed to the top of the safe, the wire inside catches the vibration from the fork and vibrates in sympathy. This vibration passes through the bind-

ing post into the outside coil and thence down into the small circuit of dry batteries, mechanically closing this circuit. An electric current is thus started which passes on and is made to close the larger circuit of dry batteries which starts a stronger current moving. This stronger current acts through wires directly on the electromagnets that throw the bolts of the concealed lock. Once these are thrown, the door may be pulled open.

After the tuning fork and wire are set to the same gauge, no other tuning fork will have any effect whatever upon the lock. As no two tuning forks are exactly alike in pitch, it is obvious that only one tuning fork in the world could open the safe, once it is closed and locked, and only the person possessing the fork could have access to the safe. However, once it is opened, it can be reset to accord with another tuning fork, whereupon the original one is useless.

Telephone Extension Bell

It is frequently the case that the telephone bell cannot be heard at all required locations, an extension bell often being necessary. A simple and an easily installed extension device on the market is here illustrated. The circuit closer is



EXTENSION BELL

placed just below the bells on the telephone box and so adjusted that when the bell rings, its hammer will move the circuit closer lever that in turn releases a contact maker which closes the local circuit of the extension bell.

Measuring Temperature from a Distance

Electrical pryrometers are now coming into industrial use in all kinds of processes, for instance in annealing or hardening furnaces, pottery and cement kilns, enameling ovens, glass works, also for use in finding the heat of furnace gases or steam, or liquid baths. In fact we might enumerate endless uses for them.

The Cambridge Scientific Instrument Works bring out several interesting kinds of pyrometers. One kind uses a thermo-electric couple mounted inside a protecting tube of porcelain or the like, for inserting it where it is needed. Wires lead to an indicating instrument which gives the amount of current, that is, the number of degrees of heat. In a second type the tube contains an electric resistance wire carrying a small current from a battery and connected to a measuring device. As the wire increases in resistance under heat, each heat gives a different current, so that the instrument either indicates or records the degrees of heat in the furnace.

An interesting apparatus works on the Féry principal. Here an open tube with a thermo-couple stands on a tripod near the mouth of the furnace so as to receive the heat rays. The readings are made on a separate instrument, as before. In the upper illustration (see next page) is a Féry pyrometer used at the Sèvres porcelain works near Paris. All these instruments allow of finding the temperature very accurately, and upon this often depends the success of many kinds of industrial processes.

In the lower illustration is shown a pyrometer designed by Charles Burton Thwing. The operator stands at a distance from the furnace door and points a tube at the opening. Inside the tube is a thermo-couple which is affected by the radiated heat. A current is formed in the couple, which is in proportion to the temperature to which the parts are subjected.

USING A PYROMETER OF THE FERY TYPE TO TAKE THE TEMPERATURE OF THE INTERIOR OF A PORCELAIN KILN

PORTABLE RADIATION PYROMETER DESIGNED BY CHARLES BURTON THWING—DETERMINING THE TEMPERATURE IN AN OPEN HEARTH STEEL FURNACE

Police Call System

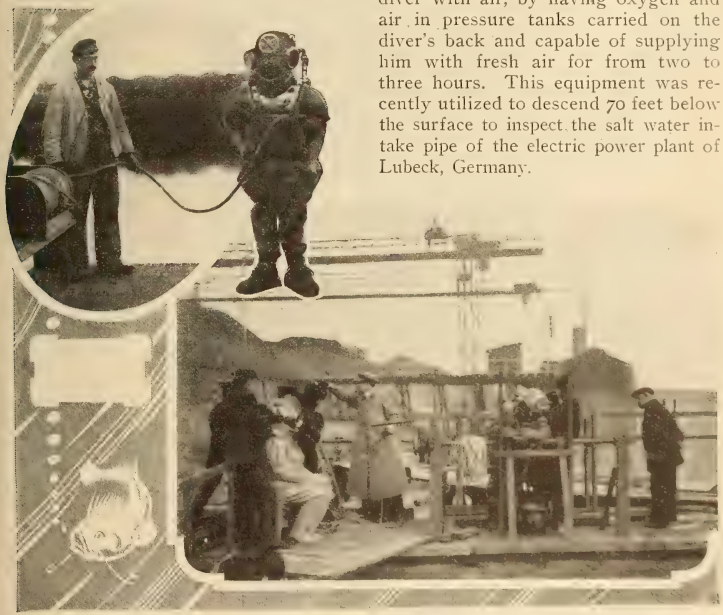
A police call system in operation at Bismarck, N. D., while very simple in make-up is found thoroughly practical and worthy of adoption by small cities.

An electric light circuit is strung throughout that portion of the business and residence districts within the patrol limits. At various corners incandescent lamps are mounted in conspicuous places, mostly on electric light and telephone poles, both of which by the way are impressed into service to carry the circuit.

Current is led to this circuit from either a switch in the police station or from a pendent switch which hangs just above the operator's head in the local telephone exchange. It can be readily seen that by these means a call for police gets prompt attention as the operator can push the button in the pendent switch in an instant and then inform the chief of police of the location, and the patrolman seeing the lights flash on immediately calls headquarters or if near by goes there at once with little loss of time.

Diver's Outfit Equipped with Telephone

The diver in the picture is rigged out in a diving apparatus equipped with a telephone so that at all times he is in communication with his assistants. The apparatus does away with a tube and pump for supplying the diver with air, by having oxygen and air in pressure tanks carried on the diver's back and capable of supplying him with fresh air for from two to three hours. This equipment was recently utilized to descend 70 feet below the surface to inspect the salt water intake pipe of the electric power plant of Lubeck, Germany.



DIVER WITH DRAGER'S SELF CONTAINED APPARATUS PREPARING TO INSPECT THE SALT WATER INTAKE OF THE POWER PLANT AT LUBECK, GERMANY

Public Entertaining Revolutionized

By ROBERT GRAU

The great slump that has taken place in the patronage of the playhouses in the country has been such that few of the men, who still tempt Fate with the production of plays, longer regard the situation with equanimity and the spectacle is now on view of the most important of these producers being intimately associated with the motion picture industry. Not only is Daniel Frohman extensively interested in the film industry but his more celebrated brother, Charles, has announced his entrance into the field of the silent drama.

DANIEL FROHMAN, THE FAMOUS THEATRICAL PRODUCER, IS NOW ALSO INTIMATELY ASSOCIATED WITH THE MOVING PICTURE INDUSTRY

In the next two months perhaps the two largest theatrical and vaudeville corporations are to adopt a mode of procedure in the conduct of the hundreds of playhouses they control that is likely to thoroughly revolutionize the field of the theater and change the theatrical map from coast to coast.

The two corporations are the John Cort Amusement Company, which owns, leases or controls 200 playhouses west of Chicago and the United Booking Offices of New York, which with its allies represents 90 per cent of the vaudeville theaters of high grade in the United States and Canada.

It is not that these two representatives of vast amusement interests are to creat an upheaval by a change of policy that is causing so much excitement on New York's "Rialto," for thousands of players and singers have been reconciled to the tremendous encroachment resulting from the amazing vogue of the photo-play. What has been feared and in some instances prophesied is that the day is near when the distinctly theatrical managers will tire of paying prodigious salaries to actors in the flesh and that they will welcome any genuine solution of the problems confronting them.

The writer, in a previous article, ventured to prophesy that within two years the talking picture would come forth in a manner that would constitute the greatest menace to the older methods of public entertaining yet recorded (and the playhouse has had to withstand many encroachments); but what worries the thespians who congregate on the "Rialto" is not so much that the talking picture is to be revealed in its latest and perfected form, but that the men who control half of the amusement output in America are to substitute for players and singers in the flesh in their theaters the

ADOLPH ZUKOR, WHO, IN CONJUNCTION WITH FROHMAN, HAS INTRODUCED THE WORLD'S GREATEST PLAYERS TO THE FIELD OF THE PHOTO PLAY

two nearest methods of synchronization by which operas, plays and spectacles will be reproduced on the screen precisely as seen and heard in theaters and opera houses, but with science simulating voice, action and color.

These two managerial interests have not acted without deliberation in this momentous procedure. Many serious conferences have been had and such vital issues as "the increased cost of living" and "reduced prices of admission" as well as "reduced salaries" were discussed from every angle. Final action was taken by both of the big concerns only when coöperation was denied by the players who alone could have prevented the upheaval by accepting lower salaries. And now comes the vital part.

John Cort and his associates have secured the exclusive rights for the Kitsee talking pictures, which are operated on wholly different lines from all previous efforts at synchronization. At the public or rather semi-public exhibition given in New York this remarkable device was voted perfect. The modus operandi has not been made public.

The United Booking Offices have effected an arrangement with Thomas Alva Edison for the exhibition exclusively, in its theaters, of the Edison speaking pictures on which the Wizard of Menlo Park has been working for many years.

When asked what he thought of the talking picture at the time of a demonstration (January 3, 1913) Mr. Edison spoke thus:

"Is it perfect? By no means, nothing that I know of is perfect; every man needs a doctor once in a while to fix him up, so anything I may invent would not be equal to a human being.

"But the way now is clear to the presentation of plays, musical comedies, operas, spectacles and other modes of public entertainment through the kinetophone; moreover it is now possible to duplicate what we call the two dollar show for five cents.

"The poor man, with a family of six, has my sympathy. He earns $2.75 a day and he can't pay the regular theater prices, and there are 1,000 such men to the man who can afford to go to the modern opera house or any other high grade playhouse. We are already near perfection, and the time is near when the whole thing that is aimed at will be accomplished, and the people of Podunk will be able to see as good plays and operas for five and ten cents as the metropolitan playgoer can see at any price. The best of literature and the best of music and drama now can be presented to the poorest persons

MARCUS LOEW, OWNER OF 30 MOVING PICTURE THEATERS IN OR NEAR NEW YORK; UNKNOWN SIX YEARS AGO, AND NOW A MULTI-MILLIONAIRE

all over the world and simultaneously.

"I have been working and thinking of this invention for 34 years. I took it up now and then and dropped it temporarily, and now, with the aid of one of the men in my plant here, we have reached a stage where we are satisfied of the ultimate outcome."

With existing conditions as they are it is not unlikely that public entertaining is about to witness an upheaval. None who have observed the vast improvement which has characterized the progress of the motion picture in its appeal to the public will need to be convinced of the importance of the new era which will be ushered in when all of the above named parties inaugurate what is to be called, so I understand, "The Theatre of Science."

"Talking Movies," Edison's Newest Invention

Thomas A. Edison tells of his Kinetophone, which produces words and sounds in synchronism with Moving Pictures

By E. LESLIE GILLIAMS

For several years the great electrical wizard has been promising the "talking movies." If anyone else had been working on it the public would have been sceptical as to a satisfactory result. But the American people have faith in Edison's accomplishing the seeming impossible, and he has never disappointed them. The present invention is his newest proof of his ability to "make good." There is only one imaginable class of people who will not thank the inventor for his latest marvel. They are the barn storming actors. For their resentment there is good reason, for it is readily imagined that in a short time there will be no more barn stormers because no one will be willing to pay for second class acting when the foremost stars are performing before the machine and can be seen and heard for a dime.

But one person can properly tell about the kinetophone. That is the inventor himself. He was found at the Edison plant in West Orange, N. J.

"Mr. Edison is upstairs in the laboratory," said Miller Hutchison, his chief engineer and personal assistant, as he led the way.

It is three flights to the "insomnia ward," as Edison's workshop is called. The wizard of electricity was ready for questions, and he discussed his ambition freely. Now and then, as he talked, his gray eyes lit up and he rubbed his silvered hair enthusiastically.

"What does your new invention do?" he was asked.

"It delivers at the exact instant of occurrence on the film any sound made at the moment such action took place. Every word uttered by the actors is recorded and delivered in time with the action; the creaking of a gate, a whistle, the noise of hoof beats, even the click of cocking a revolver, comes apparently from the screen and in unison with the motion."

"How is it done?"

"Well, it never could have been worked out without the aid of electricity. The phonograph, which is placed behind the screen, is wired to the picture machine, which may be a hundred yards away. By electrical control the speed of the talking part acts as a brake on the film, so that neither can get ahead of the other. There are special records which run as long as the film lasts. Other records can be made to come into place successively, and the performance may be carried out through a whole play. Whole operas will be rendered and the films can even be colored by hand.

"Small towns whose yearly taxes would not pay for three performances of the Metropolitan Opera Company can see and hear the greatest stars in the world for ten cents. And it will pay because of the volume of business.

"Actors will have to leave the legitimate stage to work for the 'movies' in order to get any money. This is all the better for them. They can live in one place all the year round; thus they will be able to lead a normal home life. I can see nothing in the future but big studios, centralized perhaps in New York, employing all the actors all the year round and at a better figure than they now get.

"We want democracy in our amusements. It is safe to say that only one out of every 50 persons in the United States has any real right to spend the price asked for a theater ticket. What chance has the working man for amusement whose income is from two to three dollars a day? No chance at all."

"How long did it take to work out the plan for talking motion pictures?" was asked.

"Thirty-seven years," replied Edison slowly. "It is all of that time since I made a motion picture show inside a box, by dropping a succession of drawings rapidly.

"I have thought of the talking movies and wrote of my ambition ever since. I would take the thing up and work at it for a time, drop it for several years, and then take it up again. I got the device prefected to a certain extent and then one of the men in my plant here worked it out still further.

"The great difficulties in the development of the kinetophone have been twofold. First, there was the obstacle of having the voice and the picture synchronize. Second, there was the difficulty of having a phonograph that would record the voices of the actors on different parts of the stage.

"The question of synchronism has been solved by the invention of a device that keeps the pictures to the fraction of a second in time with the words or music. The second has been solved by the invention of a delicate instrument that catches the voices of the players on different parts of the stage. The recording needle is more delicate than that formerly used and it catches the words of the player without recording the echo that formerly gave much trouble and made the voice vague.

"In making a talking picture, the actor performs exactly as he does upon the dramatic stage and his every word and action are simultaneously recorded. The action is taken in the usual method of sixteen pictures per second on the negative film, from which the finished positives are printed. The sound is taken on a large cylinder of soft wax, from which the commercial records are molded of indestructible material.

"The strangest thing of all," explained Edison, laughingly, "is that the players become embarrassed at the combination of a phonograph and motion picture camera. It is hard for them to get used to them.

"When the play is reproduced the projector of the pictures is separated from the phonograph. One is at the rear of the hall, the other behind the canvas in the front of the hall. Both are connected by electric wires, however, and the synchronizer is attached to the projector.

"The point is that the man who runs the projector cannot, even if he wishes to, turn the pictures on faster than the words. An electrical device prevents that. He may slow down too much, but an indicator immediately shows the fact to him."

The writer was invited by Mr. Edison to witness an exhibition of the invention in the perfectly equipped little theater attached to the Edison plant. First when the pictures were turned on a lecturer appeared who bowed, but there was not a sound until he opened his mouth. Then the words flowed forth appar-

ently from the picture. Behind the canvas, however, was a megaphone attached to the phonograph, from which the words really came. Behind the spectators was the projector for the reel of pictures.

The lecturer explained the intricacies of the invention. To show the actual synchronizing of time and action he dashed a plate to the floor. It appeared so real it made one of the spectators sitting in the front row jump in dismay. The lecturer played a bugle, and the swelling of his cheeks kept perfect time with the sound. He blew a police whistle, called in dogs which barked loudly, adding still more to the effect of action and sound. A violinist played a melody, and then a young woman sang, and to the ordinary observer the synchronism was perfect.

Part of a light opera was given next. A scene from "The Chimes of Normandy" was presented with lightness and delicacy of tone and music and vivid acting. That was followed by a song from "Il Trovatore." Then the quarrel between Brutus and Cassius in "Julius Caesar" was acted in a way that showed the actors and the synchronizer on the Kinetophone followed Shakespeare's advice of suiting "the action to the word."

The quarrel is so thrilling, that any lover of Shakespeare can find himself holding onto his seat entirely oblivious to the fact that only a man made machine is portraying the fierce anger of the Roman officer.

To light comedy the kinetophone turned next, giving a short sketch called "The Politician," with slang, rough vocies and gayety, showing still other phases of the new invention. Again the spectators were able to judge how the voices of the players were reproduced in keeping with their actions. The last reel showed "Dick, the Highwayman." It was full of action, daring and shooting, but at no time was there any apparent difference between the gestures and the voices.

It was observed, however, that the players apparently made an unusual effort to speak distinctly. M. R. Hutchison, Edison's chief engineer, said, however, that the phonograph catches words less distinctly articulated and that the gestures had been emphasized to prove the synchronism of the gestures and the words.

In all of these pictures the spectator was impressed by not only the perfect synchronism, but the remarkable illusion. When the actors were up-stage and walked down-stage, their voices increased in volume and in proportion to their photographed figures, and seemed to come from the right or left of the stage, as they were situated. The strange part is that one ceased to think of the phonograph and kinetoscope and his entire attention is held by the action of the piece, and he enjoys every thrill exactly as he would in a theater.

High Tension Roof Wiring

The increasing use of electric power transmission at potentials of from 60,000 to 100,000 volts has necessitated great improvements in the design of generating plants and substations, as the circuits of such installations literally carry chained lightning. The accompanying illustration shows the care which is now taken in building plants of this kind to provide for the proper mechanical support and thorough insulation of the incoming and outgoing line conductors. In the case shown, which is the roof of one of the Deerfield River plants of the New England Power Company, the 60,000 volt lines are dead-ended at strain insulators fastened into the wall of the station and from these dead-ends taps are taken as shown, to high tension insulators mounted on angle irons with latticed cross bracing to provide a firm support under heavy wind conditions. Horizontal leads are then run across the top of the roof at a height well above the head of the tallest man, and taps are

HIGH TENSION ROOF WIRING

made from these horizontals to disconnecting switches, lightning arresters and to the transformers in the station below through five-part insulating bushings. The size of these bushings, their wide spacing, and the protection of the legs of the standards supporting the insulators all emphasize the extraordinary care which must be taken to give the safest and best quality of service when dealing with such high potentials.

Why Tungsten Lamps Are Better Than Carbon Ones

The amount and quality of light emitted by a hot piece of metal or any other substance depends on the temperature, therefore the hotter it is the better will be its light giving qualities. We can make either kind of filament get as hot as we wish by making it of the proper size and length, for a given voltage. But the carbon filament will evaporate like a piece of camphor if it gets much over 1800 degrees, whereas the tungsten filaments will not evaporate until they are hot enough to melt. The evaporated carbon will collect on the inner surface of the globes and spoil the lamps by blackening them, and the blackened surfaces will weaken the light. The tungsten lamps will therefore work at a higher temperature than the carbon and will give more light for the same amount of electric energy, because of the fact that at very high temperatures the energy wasted in heat is less than at low temperatures.

To make this last point clear we must remember that light and heat are similar forms of energy; that is, they are merely wave motion of the ether. The difference between light and heat is that the light is heat vibrations that are rapid enough to be perceived by the eye. The slowest heat vibrations that can be seen give us the impression of red; the fastest ones give the impression of violet. Each color corresponds to a different speed of heat vibration beginning with red, thus: red, orange, yellow, green, blue, violet.

White light is a mixture of all the colors and its quality depends on the relative amounts of each. Carbon lamps, being colder than tungsten, have too little blue and violet in proportion to the red and yellow, hence the yellow appearance.

Also the proportion of the total visible heat radiation (light) to the invisible (heat) is less for the colder carbon filament than for the tungsten because we see that the higher frequencies (faster vibrations) disappear first, as the filament becomes cold. Suppose we start at white heat and gradually cool the filament. At first it gives off some light, say five per cent, and a great deal of heat. The heat we consider wasted since we want a light and not a heater. When it is

cooled to red heat it gives off much less heat but what it does give is all wasted energy since the small amount of red light is useless. The carbon filament may not give off any more heat than the tungsten, but the light it gives would be less and hence it is more wasteful. A red-hot horse shoe would not give off as much light as a white-hot nail but it might give off more heat, and require more coal to heat it.

There is another advantage of the tungsten lamps, which is that they will give better light on circuits where the pressure or voltage is not steady. If the pressure of a 110 volt circuit falls to 100 for any reason the carbon lamps will become so dim as to be almost useless, while the tungstens are scarcely affected at all. This is due to the fact that carbon has a higher electrical resistance when cold than when hot and when the temperature falls because of the weak pressure the resistance increases so that the current is greatly weakened. Tungsten, however, is a better conductor when cold than when hot and when the temperature falls because of the weakened pressure the resistance will become less and will therefore tend to keep the amount of current flow constant in spite of the diminished pressure.

Classes in Pulmotor Practice

Much is heard these days of the pulmotor, which has rendered such marked service in saving the lives of persons overcome by gas. A great many of the electric lighting companies in the larger cities now give free "pulmotor service," after witnessing the successful results attending the initial experiments in this direction last spring, by the Commonwealth Edison Company of Chicago.

A CLASS IN PULMOTOR PRACTICE

Originally the idea of an electric light company keeping such a device on hand was to render first aid in cases of electric shock, but these cases are few and far between as compared with cases of as-

phyxiation and we find the electric light companies in a very humanitarian way assuming the burden of rendering first aid to gas victims.

A thousand men in New York have been trained in the use of the pulmotor. The men are the workers in the electrical construction, the operating and the distribution departments of The New York Edison Company and their familiarity with the use of this mechanical life saver is due to the fact that special classes for their instruction have been held since late in October.

First the men who install electrical apparatus in the stations were taught, then the men who are in charge of the generating apparatus and finally the men who work on high tension cables of the distribution system were taught. Twelve men constituted a class and they met at all hours of the day. Some assembled in the early morning, some later in the day and some in the evening—it depended on the shift in which the men worked, for it was the desire of the company to reach them during the working hours rather than call them together in their own time.

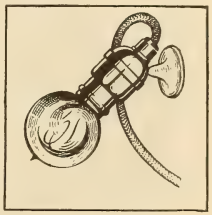
Three company physicians had charge of the instruction, which included not only the use of the pulmotor but of one of the older methods of artificial respiration; that is, by the application of pressure to the back. After the men had been told under what circumstances the application of artificial respiration was proper—that is, in cases of electric shock, gas poisoning, suffocation from smoke and apparent drowning—they were shown and given practical instruction in the Schaeffer prone pressure method.

The mechanism of the pulmotor was then explained, the men being told how to ascertain the amount of oxygen remaining in the cylinder and how to replace an exhausted for a full tank, after which the instructor showed the machine on an unconscious man. After this demonstration the class paired off for practical work, one man acting as the victim while the other put the machine in operation.

The introduction of the pulmotor in New York followed the Electrical Exposition of last October, when two victims of illuminating gas were resuscitated. There are now machines in every sub-station and the Waterside generating stations of the Edison company as well as in several hospitals.

Suction Cup Fixture Holder

An electric fixture to which is attached a little rubber suction cup that can be pressed against a window, a mirror or against any other smooth surface and by atmospheric pressure holds the fixture in position is a recent useful novelty on the market. With the Hand-E-Lite fixture is twelve feet of silk cord. The device is so small that it can be stowed away in the traveler's smallest handbag ready for service in a moment's time.



FIXTURE HOLDER.

Electric Drilling in the Oil Fields

The use of electricity in the oil fields has recently been tried out on the property of the Midway Pacific Company and has been proven a success. Well No. 2 was put down by electric power at a saving of $5,000 over the cost of drilling No. 1 on the same property, which was done by the old method.

There was a great economy in time as well and in every way the experiment proved that electric power in the California oil fields has a great future.

Electrical Men of the Times

ERNEST FREEMAN

Accepting the much cited advice of Horace Greeley the subject of this sketch in his early manhood headed for the West. Here in accord with the belief of the noted newspaper man he has "grown up" and made himself a factor in the upbuilding of the metropolis of the West—Chicago.

Mr. Ernest Freeman's birthplace is Chatham, Mass., and 1870 the year of his entrance into this world's activities. His early tendencies were toward the electrical field and his first efforts were directed in this line by the establishment in Chicago, in 1893, of the electrical contracting firm of Ernest Freeman. In 1905 this became the Freeman-Sweet Company by the entrance of Mr. F. Z. Sweet.

Besides the electrical contracting field Mr. Freeman has also been engaged in central station enterprises at Libertyville, Morris and at Seneca, Ill., these properties being later sold to the Public Service Company of Northern Illinois. At one time he was also presi-

dent and manager of the Consolidated Water and Light Company of Marseilles, Ill., now the McKinley properties.

But these successes, though prominent in themselves, might, in the ordinary course of events, not have resulted in more than a local reputation, whereas, he is known from one end of the country to the other among men who have to do with that very broad phase of construction work which comes under the head of electrical contracting. And the reason for this prominence among men of his profession is his connection with the National Electrical Contractors' Association, an organization having over 1,200 members and a powerful agent for the betterment of business methods in its particular line. That he is now president of this association, having been elected to that office at the annual convention held in Denver last July, is but a just recognition of his generous efforts in its development. Since its formation over a decade ago, he has been a dominant force in shaping its policies and has given freely of his time to the committees through which these policies are executed.

A story of Mr. Freeman is, then, quite largely a story of the Contractors' Association, and its aims and ideals, in the main his own. Some years ago the electrical contracting business was anything but a holiday affair. There was very little standardization of methods, no co-operative effort and most of the contractors went around with chips on their shoulders—and there was chaos. Finally some of the more far-sighted ones saw that if the business was to prosper, singleness of interest would have to be the rule instead of the cut-throat methods then frequent. So a small group of them, not over 30, assembled and formed the National Electrical Contractors' Association. This was some twelve years ago. Its force began to be felt immediately. Out of it came such co-operative benefits as the standardization of the methods of electrical construction and the establishment of a uniform system of symbols to be used in plans and specifications for electrical work, which did away with a great deal of confusion in interpreting the same. Although the association, of course, does not say to any member "You shall charge so much for such and such work," yet it has gone so far as to get up a very valuable book of the loose leaf variety, containing every electrical manufacturer's list prices, discounts, etc., on all construction materials. This book is kept up to date and new sheets are issued by the association through the co-operation of the electrical manufacturers. Added to this are suggestions for resale prices on materials and prices for construction work, which though not obligatory on members are recommended and if followed out will result in a fair return to the contractor and harmonious relations between him and his fellow contractors and the publice which he serves.

In straightening out such matters as these the association has been active and persistent and it may be said that one of the mainstays in the work has been Mr. Freeman.

Even now he has under way a universal bookkeeping system which will meet one of the most urgent needs of the electrical contractor. The electrical contractor as a rule is a poor business man and his accounts are recorded usually in a loose leaf book carried in his hip pocket. When a job is finished he has no accurate way of checking up to ascertain how much it has cost him and if he has done the work at a loss he has no method of determining where the trouble is.

One of the things Mr. Freeman desires most to accomplish during his presidency is that of placing in the hands of every association contractor a system of bookkeeping applicable to this industry and so simple that the contractor will have no difficulty in checking up.

One of the stories he delights to tell illustrating the co-operative and friendly spirit engendered among the members has to do with a contractor in a large city in Texas. This contractor was new at the business. At best his resources were small and he had bought a large bill of goods on consignment, returnable in six months if not sold. The six months rolled around and most of the goods were still in his store. He had done very little business, creditors were insistent, and he was very down in the mouth. Finally came the sheriff and closed him up and took away his fixtures which were to have been returned.

His extremity became known to the other electrical contractors in the city—fellow members with him in the Contractors' Association. Immediately they formed a pool and staked him, so to speak. They got his fixtures back and opened his store and furnished him some ready money to tide him over. All these brother contractors turned over to him one job of work each, which they had secured for themselves—enough in all to keep him busy for a considerable time—and even lent him men to do the work. He is now one of the most prosperous contractors in that city.

Before the formation of the Association his fate would have been a different one. And it is this very spirit of live and let live, of co-operation instead of elimination, that Mr. Freeman loves in his association, and which he has been so instrumental in bringing about.

On entering Mr. Freeman's offices one is impressed with the quiet, systematic handling of business and this quiet, systematic way is characteristic of the man himself. If he is making a speech he talks slowly and seems to measure each word; but every single word he "gets over," to use the venacular of the stage. While made to feel perfectly at home, the interviewer's "Tell me something about yourself" is met by a smile and a suggestion that friends and other sources must be appealed to if one is to find out how this brown eyed man of medium height and quiet personality has won success.

Telephones in the Vatican

The Vatican has had a telephone system since some time after the present Pope came into power. He is a most progressive man and believes in the adoption of facilities to expe-

TELEPHONE SWITCHBOARD IN THE VATICAN, IN CHARGE OF A UNIFORMED ATTENDANT

dite the enormous business of the Vatican. This telephone system is not only an interior system, but has connection with the outer world by a trunk line or two.

While the Pope does not often use

the system himself, since his secretaries attend to details of Vatican business for him, it is used many times a day on his official business, to transmit his instructions to the various church dignitaries, some of whom reside at the Vatican and many others outside. It can be connected with the long distance lines of Rome and thus with those of the other European cities having telephonic communication with Rome. The picture herewith shows the private exchange telephone switchboard in the Vatican in charge of a uniformed operator.

Missoula's Lane of Light

"There are cities with a greater number of similar lights in use; there are cities which have spent thousands for a more artistic arrangement of ornamental posts and clusters, but there is no city that has a district of equal size so well lighted." So says *The Missoulian* of Missoula, Montana.

There are no confusing shadows, no dark corners, and the beauty of the window displays is greatly enhanced by the light from the new lamps. The illumination from without has made it possible for many merchants to reduce the number of lamps within and has been the means of effecting considerable saving to them in this manner.

The accompanying picture of the city's main thoroughfare at night speaks forcefully of the street illumination. Luminous arc (magnetite) lamps set upon brackets eighteen feet above the street are used. The brackets are attached to steel poles set opposite each other on the street, and spaced 100 feet apart along the curb.

Small expense was incurred by the city in connection with the installation owing to the liberal manner with which the matter was handled by Mr. W. A. Clark of the Missoula Light and Water Company. Missoula is the first city west of the Mississippi to adopt these lamps. The first town in which they were used was New Haven, Conn. At present there are ten installations in different parts of the United States, and a large number of towns are considering their use.

NIGHT SCENE IN MISSOULA, MONTANA

Electrical Interests of Women

EDITED BY GRACE T. HADLEY

A Lesson in Values

Mrs. Fitzgerrell, radiant and successful, awaited her husband in their well furnished dining room; when he appeared, she rang for the maid to serve the bouillon. Then facing him across the spotless table, she proceeded eagerly to demand:

"Have you heard the news?"

"What news?" inquired her husband leisurely.

"I was elected president of the Suffrage Society at the meeting today," was the proud announcement.

"Then I presume you are going in for votes for women and that sort of thing."

"Exactly!" exclaimed Mrs. Fitzgerrell.

"Is suffrage taking precedence over bridge and teas and becoming fashionable?"

"Indeed it is among thoughtful women. It is in the very air and even frivolous women are beginning to wake up."

"I don't see why women want to vote," began Mr. Fitzgerrell, helping his wife to a choice bit of rare beef. "Don't I provide well for you? Don't I give you the best of everything?"

"Yes, you are a dear, but we women want to be real citizens. We have had a great deal of experience in practical housekeeping within the four walls of our homes and now we want to have a hand in municipal housekeeping."

"Well, we business men are so busy tending to our own affairs we have been in the habit of letting the politicians run things."

"That's just the point. Property owners and business men do not take sufficient interest in municipal affairs. You are all too busy making money. You say things about the grafters, pay the graft and keep right on making money."

"But I don't see how it's going to help if women mix up in such matters."

"To illustrate," began Mrs. Fitzgerrell judicially, "there is the initiative, the referendum and the recall which should be in operation now in practical politics. I have practiced the recall for some time in the administration of my home affairs."

"I don't think I quite understand."

"When you voters put a man in office he is elected for a certain length of time and no matter how crude or how inefficient he may prove to be, or how much positive damage he may do in municipal affairs, there he stays until his term expires. Could anything be more foolish or more wasteful?"

"I admit your point. What is your plan?"

"Well, when I employ a maid who proves to be inefficient, I put into effect the recall. If she begins to break up the dishes. I do not let her continue to break up my best china for two whole years, I recall her at once and dismiss her."

"And do the dishes yourself?" inquired Mr. Fitzgerrell quizzically.

"No," returned his wife calmly and serenely, "I get an electric dishwasher and save my chinaware."

Mr. Fitzgerrell laughed in his hearty, wholesome way.

"Would you suggest an electric dish-washer for municipal management?"

"No," returned Mrs. Fitzgerrell brightly, "but I would apply electrical efficiency to practical politics. Instead of doing the municipal housekeeping in the clumsy, cumbersome way it has been done, we up-to-date women would introduce the principle of efficiency in civic affairs. The slogan of the modern housewife is, 'efficiency, economy of operation and values.' "

"Values!" repeated Mr. Fitzgerrell vaguely.

"GREAT SCOTT! BUT I'VE HAD A GREAT LESSON IN VALUES"

"Yes, women have always been the great conservers of social values. All men do is combine and recombine the elements they find and sometimes the combinations they make are bad, while women have always been accustomed to give things time, place and form values."

"You have a habit, Marian, of sometimes getting beyond my depth," observed Mr. Fitzgerrell. "You know I am just a plain everyday banker, and not accustomed to sounding the subtleties of psychology or chemistry."

Br-r-r-r-r! buzzed the front door bell. The maid entered promptly with a folded paper in hand which she gave to Mr. Fitzgerrell.

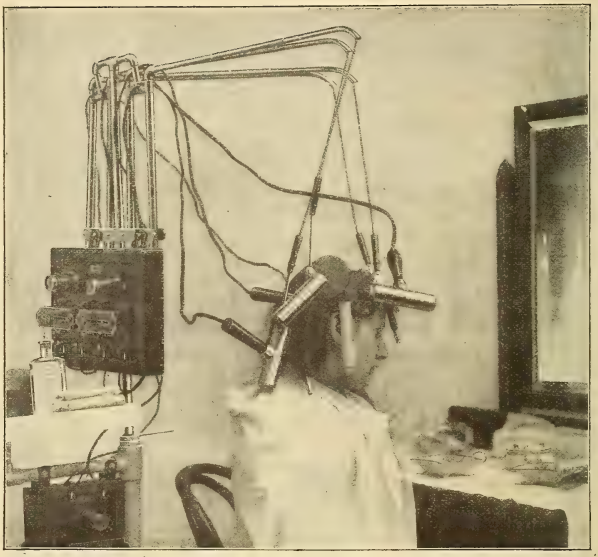
"Great Scott!" exclaimed that gentleman in startled tones.

"What is it dear?" enquired his wife sweetly.

"It's the bill for the electric dish-washer," remarked the head of the house weakly. "You've saved your china, Marian, but—"

"But what?" said his brilliant wife.

"Oh, nothing, it's all right, but I've had a great lesson in values and of course that's worth something."



FOUR HEATER OUTFIT FOR HAIRDRESSING ESTABLISHMENTS

The Permanent Hair Waver

"What would you do with hair like this?" The question was asked by a comely young woman, who possessed a clear complexion, hazel eyes, good features and a tendency to make the most of her talents and her natural charms, but her hair was her despair. It was irregular in length and hung down in lanky locks about her eyes. Every morning with a hot curling iron she gave these locks a few twists on the curler and pinned them up out of her eyes, but by nightfall they hung disconsolately downward without a vestige of curl in them, hence her despairing inquiry, "What would you do with hair like this?"

"Well," remarked the friendly visitor, "I would have such hair put into a permanent wave."

"A permanent wave," said the young woman, "why what is that?"

"The permanent wave is a new patent process of changing straight hair into natural wavy hair by electrical and chemical process of recent discovery. It is the invention of an eminent specialist formerly of Paris and Germany. It is well known in Europe where it has delighted many women, but women on this

side are quite mystified as to its action.

"To explain simply, just picture a strand of hair as a horn tube. Children's hair and naturally curly hair have tiny pores leading from the surface into the interior of the tube or central channel of the strand of hair. These tiny pores become clogged by a fungus growth as the years pass and with the closing of the pores opening into the central channel, the hair becomes lank and straight, losing its charm and becoming difficult to dress becomingly. The permanent hair waver produces the wave or curls of any style by opening these tiny pores, by removing the fungus growth from the affected straight hair, cleansing it and giving to it the beautiful texture as well as other advantages of natural wavy hair. When once waved, the hair remains so until it grows out from the roots."

Exorbitant prices are obtained by doing this work and the demand has been greatly in excess of the supply of skilled operators who have learned to do it. It is possible for a skilled operator and assistant to wave two heads of hair a day, which would mean an income of something like sixty dollars a day. This can be done at the lady's own home providing there is electricity available, so that it is not really necessary to have an establishment to do the work.

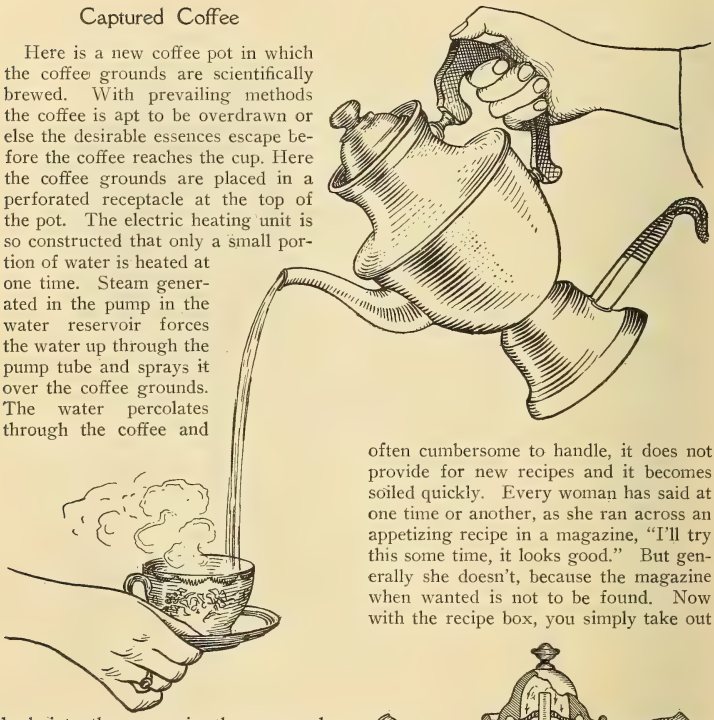
The hair must first be shampooed and it is advisable to have this done the day before the waving is done. After arranging the outfit so that everything is convenient for use, the work is begun by dividing off a portion of the hair beginning in front and tying close to the roots with the tying cord. A strand of hair is wound very tightly around the curler beginning at the end that is tied and the winding must be perfectly flat and smooth. Tie the thread after the entire curl is wound and it is ready for the application of the chemical. The strand of hair is then covered with a strip of gauze that protects the hair from the powder after the chemical has dried. A flannel strip moistened with the chemical is wound over the strand above the gauze. It is now ready for the asbestos tube which is slipped over the strand. A shield protects the scalp from the heater. The electric current is then turned on until steam appears from the ends of the heater. This heat creates a vacuum and the suction combined with chemical action draws from the hair the particles that close the cells. By this process the hair is transformed from straight hair into a naturally wavy condition. Hair that is naturally wavy is free from cell clogging fungus growth and if hair that has been subjected to this treatment should become straight, all that is necessary to restore the wave is a good shampoo. Such hair is not affected or straightened by rain, moisture, or shampoo. It is claimed that the process is a benefit to the hair.

A SMALL OUTFIT IS MADE FOR HOME USE

A complete outfit for giving this wave at home consists of two electric controllers, heaters, curlers, tubes, chemical and other accessories.

Captured Coffee

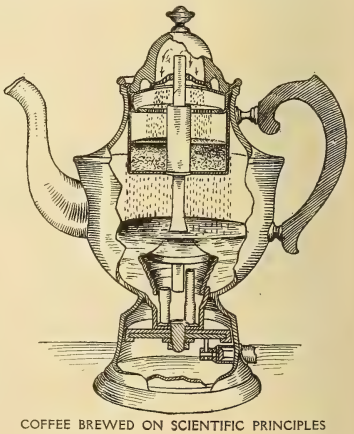
Here is a new coffee pot in which the coffee grounds are scientifically brewed. With prevailing methods the coffee is apt to be overdrawn or else the desirable essences escape before the coffee reaches the cup. Here the coffee grounds are placed in a perforated receptacle at the top of the pot. The electric heating unit is so constructed that only a small portion of water is heated at one time. Steam generated in the pump in the water reservoir forces the water up through the pump tube and sprays it over the coffee grounds. The water percolates through the coffee and back into the reservoir, the process being continuous. The little pump inside this pot is constructed on the same scientific principle as a city pumping station.



The aromatic, volatile essences do not escape but are captured, producing a delicious beverage.

Recipe Box Aid to Housewife

The recipe box is a quick and convenient system to take care of cooking recipes. Each recipe is on a separate card filed behind appropriate guides. New recipes may be added at any time. Every woman who has used the ordinary cook book has realized its limitations. It is often cumbersome to handle, it does not provide for new recipes and it becomes soiled quickly. Every woman has said at one time or another, as she ran across an appetizing recipe in a magazine, "I'll try this some time, it looks good." But generally she doesn't, because the magazine when wanted is not to be found. Now with the recipe box, you simply take out



COFFEE BREWED ON SCIENTIFIC PRINCIPLES

a blank card, paste the recipe on one side, make any notations you wish on the other side and file in the box.

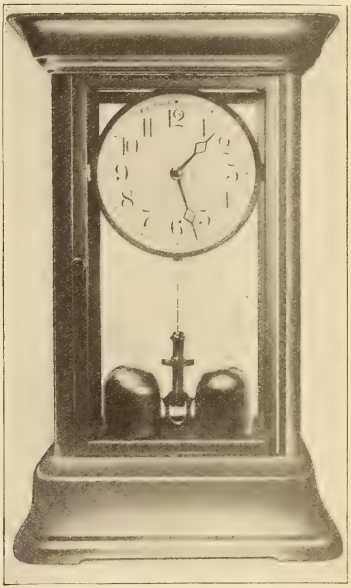
There are the hundred-and-one household helps which are encountered in the day's reading. Some are valuable and should be preserved. With the recipe box at hand it is only necessary to clip the article, paste it on a card and file it behind the proper guide in the box. The recipe cards are unique in that they give the ingredients in one column, the quantity in the next column and remarks occupy the third space. In the ordinary cook book the ingredients, quantities and directions are all run together and it is often difficult to differentiate one from the other.

Clock That Needs No Winding

For years many inventors have tried to produce a practical and ornamental electric clock for the home; one which would not need to be wound and would yet be so simple in its mechanism that it could be produced at a price within the reach of all.

A new clock said to fulfill these requirements is sold under the trade name of the "Never-Wind." The case is of polished brass, heavily gilded and lacquered, 9½ inches high, 6 inches wide and 5½ inches deep. The clock operates without springs, weights or wires or any outside connections, the motive power being an ordinary flashlight, dry battery concealed in the base. The cost of the battery is 25 cents and as the battery runs the clock six months or more, a cent a week for battery power saves the trouble of winding the clock.

From the battery in the base, two small wires run in one of the hollow posts at side of clock, one from the carbon and one from the zinc contacts of the battery, these wires connecting, one with an electro-magnet and one with the pendulum wire at very top of clock movement. The pendulum weights do not swing to and fro as in an ordinary clock but revolve first about one and a half turns to the right and then to the left. On the pendulum wire is a platinum contact pin, which by the action of the pendulum is brought into contact with a platinum plate, thus completing the electric circuit, pulling up the armature at bottom of the magnets which in turn works a pawl on the ratchet wheel

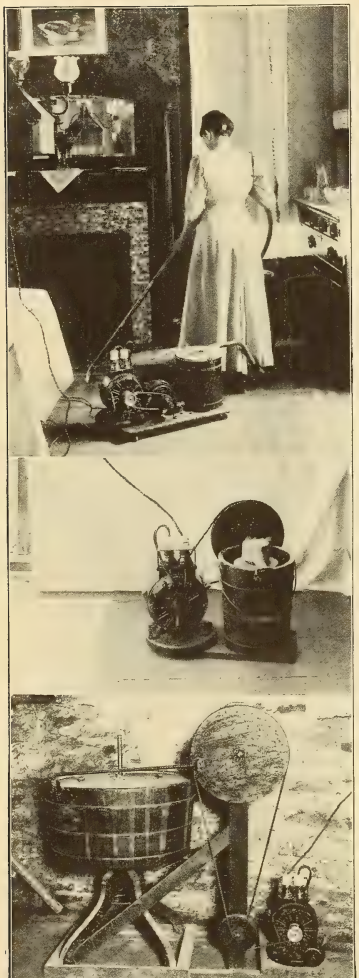


CLOCK OPERATED BY DRY BATTERIES

and thus the minute and hour hands are operated.

A regulating nut just above the pendulum weights can be turned to the right for "fast" or to the left for "slow," in this way shortening or lengthening the twist of the pendulum wire, which in turn regulates the time of the clock.

It is amazingly simple and needs only to be seen to be appreciated, especially by all women who forget to wind their clocks or watches.



SOME OF THE USES OF A SMALL MOTOR IN THE HOME

A Versatile Small Motor

Mrs. Deemer, a Pennsylvania woman, has solved the servant problem in a very unique and efficient way by letting a small motor do her hard work. It is true, of course, that many women have a motor driven washing machine, or a motor driven vacuum cleaner, but usually the motor does just one thing and no other. Mrs. Deemer's, however, has seven distinct duties. It runs a vacuum cleaner, a washing machine, a grinding wheel, a polishing wheel, a ventilating fan, a sewing machine and an ice cream freezer. Current is taken from the nearest lamp socket and the motor is started by simply turning the switch.

To operate the vacuum cleaner, the motor, which by the way doesn't weigh much more than a flat iron, is clamped to a small platform and belted to the vacuum cleaner pump, which with the dust receptacle is also mounted on the platform. The platform has casters and rolls around very easily. With this outfit it is easy work to get the dust out of the rugs, tufted furniture, portieres, mattresses and corners hard to get at with a broom.

In a similar way the motor is attached to the washing machine. On wash day the motor is started, and while the family is at breakfast the first tubful is being washed; the second is put through while the dishes are being washed. No attention is needed except to put in and take out the clothes.

For polishing silver a chuck is screwed on the extended shaft of the motor, a cloth wheel is slipped on and it takes just a few minutes to polish all the silverware. By substituting an emery wheel the kitchen knives, choppers and the like are kept in good usable condition.

A fan wheel can also be attached to the shaft and used to circulate the air in the summer and to distribute the furnace heat throughout a room in the winter.

By transferring the motor to the sew-

ing machine all the hard part of sewing, the treadling, is eliminated. A small idler pulley permanently attached to the motor (shown in the illustrations) is connected by a small chain to the treadle. The belt is run from the motor pulley, over the idler pulley and around the machine hand wheel. By pressing on the treadle the belt is tightened and the machine starts. The speed of the machine is controlled by the pressure on the treadle from a stitch at a time to as fast as desired.

Lastly, the motor turns the ice cream freezer. This was originally hand operated but the crank was replaced by a homemade wooden wheel grooved for a belt. To make ice cream electrically takes about five minutes against two or three times as long by the tiresome hand method; consequently homemade ice cream is almost an everyday occurrence.

It was very easy to apply this motor to so many useful duties and it seems strange that there are so few instances of this kind. It is rated at 1/6 horsepower and costs about two cents an hour to run.

Electricity as an Invigorator

A certain person was ill and on the verge of collapse. She was sure that she could not live through the day, and it was to be a busy day. It was impossible for her to get away to the Springs, but there was hope in an electric bath treatment. There were some very fine baths in the city where she lived, and she resolved to try them when she was about ready to drop from exhaustion.

First she was placed in an electric light cabinet for fifteen minutes, then she was hustled into a tub of warm water with electric currents vibrating through it. "Now, you are going to feel this in your shoulders," said the attendant, and she felt it. "Now you are going to feel this up and down your spine." She felt it. There was a merry little sizzling song on the switchboard and the lifegiving currents pulsed through the warm water. Then came an excellent salt rub and an exhilarating pine needle shower, and the healing process was complete. The sick one was well. "How do you feel?" inquired the attendant, poking her head into the rest room an hour later. "Fine," exclaimed the patient; "I think I'm about well and I'm as hungry as a bear."

Mechanical and electrical therapy are coming into more and more use in treating ailments, and the results obtained are such as to cause the greatest hopes for the future of this kind of treatment. In this field electricity has no competitor, for the science itself is built on electricity.

Thoughts for Housewives

When women are free from the barbarities of present methods of housekeeping—the market basket, the kitchen utensils, the scrubbing brush gone from every house; electricity everywhere spreading warmth and life, they will still be forced to do a certain amount of work. This cannot be avoided even by the help of the most perfect apparatus or by cooperative methods, provided the house is not to be replaced by the barracks.—*Ellen Key.*

Wherever a true wife comes, home is always around her. The stars may be over her head—the glow worm in the night-cold grass may be the fire at her foot, but home is where she is; and for a noble woman it stretches far around her, better than houses ceiled with cedar or painted with vermilion, shedding its quiet light for those who else are homeless.—*Ruskin.*

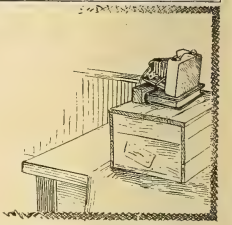
You talk of the fire of genius. Many a blessed woman who dies unsung and unremembered has given out more of the real vital heat that keeps the life in human souls, without a spark flitting through her humble chimney to tell the world about it, than would set a dozen theories smoking or a hundred odes simmering in the brains of so many men of genius.—*Oliver Wendell Holmes.*

Junior Section

To Take Your Photograph.

With an ordinary camera and the apparatus described, one may take his own picture in a darkened room and obtain fairly artistic results. The flash part of the equipment requires a 3½ volt battery, a 3½ volt tungsten lamp, fourteen feet of flexible wire to make connections, two battery binding posts, a strip of copper or brass ½ by 4 inches and a block of wood. Drill a hole in the strip the same size as the binding post screw and about ½ inch from the end, then connect up the wooden block as shown with the switch in series with one of the wires running to the lamp.

To take your own picture, place the camera on a table and focus it upon some object that is about the same height as your shoulders and the right distance away. Leave the camera setting in this position and turn out the lights as the room should be dark. Now open the shutter of the camera, place the lamp in your hands, using them as a reflector and when you have about the right position press your foot against the spring switch. This will light the lamp and in turn light up your face. The exposure may be about 30 or 40 seconds at the end of which the foot releases the spring contact. Before turning on the light close the camera shutter. A few trials will settle the time question. Photographs taken in this manner do not have the startled expression characteristic of flashlight pictures.



METHOD OF TAKING ONE'S OWN PHOTOGRAPH, AND THE RESULT

The Power of a Meteor

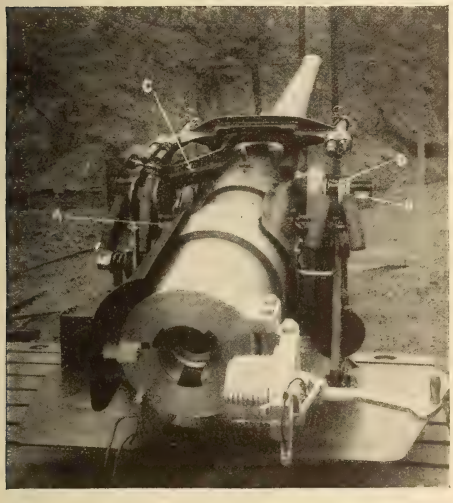
A most curious observation of the effects produced by a meteor at sea was once made a part of a government report.

Some years ago, the captain of the British steamship "Nerano," when a little more than 200 miles southeast of Cape Clear, during a voyage from Baltimore to Havre, saw a meteor that appeared to pass close to his ship.

An observation of the North Star taken soon after the appearance of the meteor showed a surprising result. The

direction of the ship's compass needle had been changed no less than eleven degrees. Before the meteor passed, the needle had pointed about five degrees 30 minutes west of true north, but now it pointed five degrees 30 minutes east of north.

That the meteor had caused the change was indicated by the fact that within 24 hours the needle returned to its former position, moving slowly back about eleven degrees toward the west.

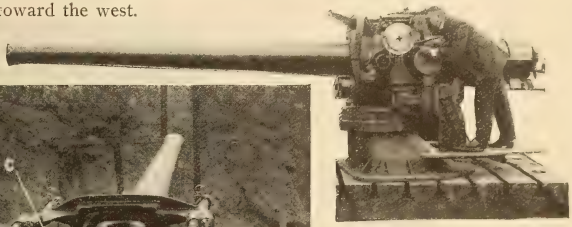


HEAVY ORDNANCE WHICH IS MANIPULATED AND FIRED BY ELECTRICITY

Equally great effects have been produced upon ships' compasses by lightning, but in such cases the bolts have actually struck the ship. The meteor seen by the "Nerano" did not touch that vessel and while no estimate of its actual distance was made, it was probably considerable, since the report contains no record of its having been observed to fall into the sea.

Aiming and Firing a Heavy Gun

Comparatively heavy ordnance, that is, guns as large as four and six inch bore, are aimed and fired in much the same manner as the lighter guns, by aiming directly through the telescopic sights from a position at the breach of the gun. But of course the piece is much too heavy to swing and depress readily by hand, so



the work is done by motors and electricity also is used for the actual firing. In the four inch pedestal rifle shown the operator is in position at the variable speed gear mechanism. His left hand rests on the lever (A) controlling the electrically operated pointing mechanism. At (B) is the trigger for electric firing. At (C) is a handle used for percussion firing, which may be used if necessity demands. At (D) is the circuit closer putting the electric firing parts in readiness for action upon pulling lever (B).

Strange Electric Storm

One night in February, in south latitude 33 degrees, west longitude 38 degrees, the sailing vessel Ville-du-Havre encountered a most remarkable electric storm. The rain fell in torrents, and the ship appeared to be electrified, the mast heads flaming like giant candles. Strange

lights traveled over the rigging, and after every flash of lightning a part of the vessel which had been newly painted remained for several seconds glowing with phosphorescence. The lightning, which was very frequent, instead of displaying itself in zigzag lines, took the form of flying bombs, which exploded with outbursts of light that illuminated the whole sky. Before and after the more violent explosions of thunder fierce gusts of wind swept the ship. This terrifying experience lasted for five hours with no respite.

An Archimedes Tower

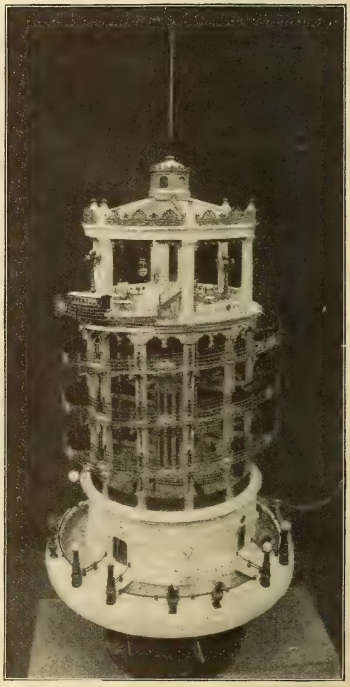
John B. Daleo, a young Italian sculptor, residing at 228 Degraw street, Brooklyn, N. Y., has constructed a remarkable electric tower, which he has named after the gifted Sicilian, Archimedes. He has so designated it because it is built on the plan of what is known as the Archimedes screw.

The tower measures six feet six inches from base to tip of flagpole and is at once artistic and ingenious. Electricity is employed for propelling the cars, for lighting and for running the water wheels.

In the upper part of the tower is a restaurant, at the entrance to which the car stops. All the electric wires are hidden in the construction, making accidents therefrom impossible. The cars and lighting require 190 volts. Thirty-six tungsten lamps, corresponding to the light of 216 candles, are used for illumination.

The base of the tower, constructed of wood, is 40 inches in diameter. There are four entrances to the building, which are led up to by a flight of steps. The fountains at the side of the doors spout water into a pool, where small fish might be kept. The candelabra in front of each door give the proper light. Eight decorative vases are placed around the base. The bottom of the tower is made of plaster composition, the inside of which contains the electrical apparatus.

The railway structure is of wood and casting metal. At the bottom is the platform station for the loading and unloading of the cars. The electric car starts from the station and runs on the outside track to the restaurant at the top, remaining here but a second or so, and then starting on the return journey, taking the inside track, which connects with the outside one at the bottom. (This railway is an ingenious piece of work.) When a car stops at the upper station, another is at the lower platform. Both cars are in



ARCHIMEDES TOWER

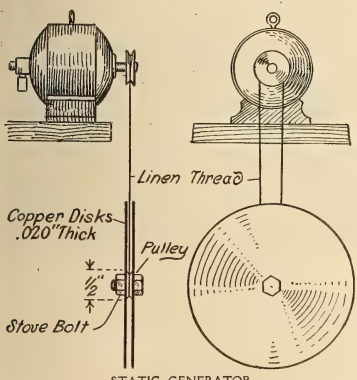
motion at one time, controlled by a separate motor. A fence is built for the safety of the passengers, with a broad walk on the inner side of the railway. The third-rail system is used.

Certainly Mr. Daleo has shown considerable genius in constructing the tower, but the question naturally arises—of what practical use is it? In his opinion, it might serve as a model for a large building at some seaside resort, utilizing the base as a theater and the upper part as a restaurant. One can easily imagine that a building constructed after this model, brilliantly lighted by electricity, with the cars ascending and descending on the winding tracks, with the music floating out on the upper air and with the chance of dining in the cool breezes hundreds of feet from the ground, would attract great throngs and could be made to be a paying investment.

Odd Static Generator

The outfit here illustrated I accidentally discovered will generate static electricity.

Upon a shelf or the edge of a table fasten a small motor that will run at a



STATIC GENERATOR

speed of about 3,000 revolutions per minute. On the shaft of the motor there should be a small grooved brass pulley. Provide a second pulley about ¾ inch in diameter and a small stove bolt that just fits the hole in it. From thin sheet copper cut two disks exactly alike, and six inches in diameter. Drill a hole in each disk of the same size as the hole in the pulley, and fasten the disks, one on each side of the pulley with the stove bolt as shown. Now make a belt of heavy linen thread. Place the thread over the pulley on the motor and set the disks' pulley upon the loop, thus leaving the disks suspended in the air. Start the motor, give the disks a turn and as soon as they come up to speed, they will act as a gyroscope and keep balanced. Take a piece of copper conductor in the hand and bring the metal near the disks. A ¾ inch spark can be taken off. An incandescent lamp held near the disks will glow with a weird blue light.— E. H. SAMEN.

Short Circuits Produced by Birds

Birds perched on or flying between the wires of a high tension system often cause a short circuit which may result in considerable damage at the central station and also in the electrocution of the bird. This occurs, however, only with birds having a considerable spread of wing; but with these it happens so often that in certain regions the total destruction of birds of large wing area is likely to result.

A case of this kind occurred recently in Germany, caused by a panic in a flock of starlings on the appearance of a hawk. Several of the birds and the hawk were caught between the high tension coils and the insulators in such a way that the high tension cable was grounded; but as the ground wire of the tower carrying the insulators and the transformer had become a bad conductor as the result of dry weather, the high tension current passed by the low tension circuit line to the earth at the same point, occasioning damage and fires in the homes of the consumers, as well as interupting the light service. The intensity of the current arising from the short circuit formed by the birds was not at any time great enough to put into action the automatic apparatus at the station.

And Their Friend's Were Led to It

A dingy little confectionery and tobacco store has stood for years in the center of the ghetto district, Pittsburgh. Nobody remembers just how long it has endured. Many grown-ups have been youthful patrons. From time to time it has changed hands, and with the last change it came

THE STREET WAS HALF FULL OF SHOUTING YOUNGSTERS

into possession of a young man, who introduced some innovations, among them a modern penny-in-the-slot scale.

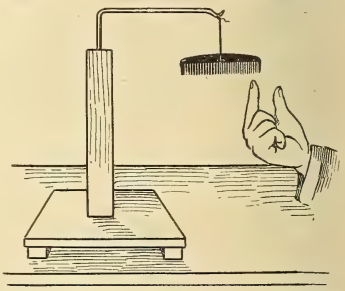
From the first the scale seemed to become the center of attraction for the youthful population, who tried to work it without the assistance of pennies. The storekeeper soon realized that unless something was done the destruction of the scale was imminent.

An old high tension magneto in the back cellar offered an inspiration. Forthwith it was installed behind the counter. One terminal was grounded. A concealed wire was run from the other terminal to the metal body of the scale. The scale was propped up from the damp bricks on some dry blocks of wood dipped in melted parrafin.

Very shortly, some youngsters approached and commenced playing with the scale as usual. The storekeeper hied himself back of the counter and gave the magneto a vigorous turn. The kids got the surprise of their lives. Undaunted, however, they touched the scales a second time, receiving another shock. The storekeeper saw them make off up the street at a run and inwardly exulted but he was a poor student of kid nature. In a few minutes the original kids returned with three more. The newcomers were led up to the scales, experienced a shock, wondered a moment, and then "beat it" up the street to find some new victims. In a short time the street was literally half full of shouting youngsters fighting for a chance at the scales. About this time, the storekeeper decided that electricity might be very efficacious for some purposes but here was a case where it was a signal failure.

Controlling Finger

Electrify a rubber comb by rubbing it briskly with dry flannel. Suspend it as shown by a silk thread previously at-



COMB THAT TURNS UNDER THE INFLUENCE OF AN ELECTRICAL CHARGE

tached to it. When a finger is held under it the comb will follow the finger, turning round and round as the hand moves.

Fishing Up a Cable

A copper wire, coated with gutta-percha, was, in the year 1850, laid under the channel between England and France. Messages were sent from coast to coast, and men of science and capitalists in both countries were congratulating one another upon this triumph, when one morning, soon after the completion of the great work, communication suddenly ceased.

That morning, it appears, a French fisherman of Boulogne was going out in his boat. A British seaman, who at the moment had nothing to do, was seated on a coil of rope on the dock, looking out over the sea and meditating as he smoked his pipe. The Frenchman invited the Britisher to join him in his little expedition for fish.

Away went the two, bearing to the northward along the coast before a light breeze, until they finally brought up off Cape Grisnez.

Here the Frenchman let down his trawl and fished up among other curiosities of the deep the submarine cable before mentioned. Both he and his British friend were, to say the least, surprised. To the fisherman it seemed a species of seaweed; to the Britisher a form of petrified marine monster. The latter, handing his friend a heavy knife, the Frenchman forthwith cut off a small portion of the cable and let the end go.

The two bore their prize to Boulogne, where it was exhibited by them as a specimen of rare seaweed with its center filled with gold! Meanwhile the telegraphers at each end of the cable sat gazing in dismay at their useless instruments.

HANDLING A CARNIVAL CROWD IN MANILA

Handling the annual carnival crowd in Manila requires a lot of forethought on the part of the schedule expert of the street railway system. In the Walled City the streets are so narrow that they accommodate but a single track and the operation of cars to avoid congestion becomes a fine art when traffic is unusually heavy. Often a dozen cars get so close together in creeping through the narrow thoroughfares that they resemble a train of trolleys. All the rolling stock is bedecked in flags during fiesta days and from the large variety displayed one knows that the holiday is an international one, rather than a celebration purely for Americans. For instance, the British don't care to fly the Union Jack along side the Stars and Stripes on the Fourth of July and Spaniards keep the Red and Yellow of Spain in the dark on Occupation Day.

Popular Electricity Wireless Club

Experimental 200 Meter Wave Sets

By PHILIP E. EDELMAN

PART I

The wireless law practically limits all amateur experimenters to 200 meter wave sets. Although this limitation means that the design and size of the apparatus must conform to certain requirements, it will not be a difficult matter to establish a good 200 meter experimental station.

The purpose of the present article is to give specific data for experimental 200 meter sets which comply with the law and it aims to present the matter so that the readers can establish the stations without calculating the circuits and dimensions. The construction and use of the series condenser will be taken up first because there are many readers who already have outfits, and who do not wish to go to great expense to comply with the law. The series condenser will enable them to make their old outfits comply with the law in most cases at very little expense. The remainder of the chapter will consider sets which use a short aerial. The object is to give definite data for particular sets rather than general data for any desired case.

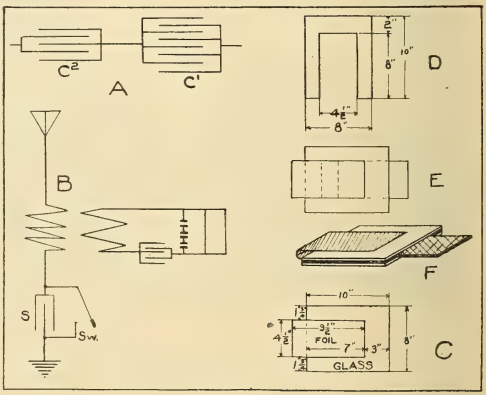


FIG. 1

THE SERIES CONDENSER.

It is a well known fact that the wave length depends upon the capacity and the inductance in a given circuit. Now in most of the old outfits the value of the capacity and the inductance is too large to comply with the law because the aerial is too large. At the same time, the large aerial is an advantage for long distance receiving, and as there is no restriction on the receiving wave length, it is very desirable to keep the old aerial as it is. When the large aerial is the main item which keeps the value of the circuit too high to comply with the law, a small condenser can be inserted in the aerial circuit to keep the wave length within the limit. In this case, the large aerial may be used as it is, for receiving purposes.

The series condenser arrangement

operates on the principle that the combined capacity of two condensers which are connected in series (A, Fig. 1) is less than the capacity of the smaller condenser. Thus if the capacity of the condenser (C^1) may be represented by ten units and the capacity of (C^2) by two units, the combined capacity of (C^1) and (C^2) in series is less than two units. The antenna itself may be considered as the larger condenser because it consists essentially of conductors forming a capacity with the earth, the air serving as the dielectric.

The arrangement is shown at (B) Fig. 1. The aerial proper corresponds to (C^1) in (A) and the series condenser (S) corresponds to (C^2). The switch (Sw) is useful when automatic or break arrangements are used, as the series condenser is not desired for the receiving circuit. It may be omitted, and in any case the switch is always left open when transmitting. It will be understood that the series condenser makes the capacity of the secondary circuit less and consequently lowers the wave length. The aerial system can thus be operated at less than the natural wave length and this new wave length can be limited to 200 meters by the use of the proper size of condenser. The size for this condenser is best determined by trial, using either of two methods, as follows:

1. *Hot Wire Ammeter.* The primary circuit having been fixed at 200 meters, (See "How to Comply with the New Wireless Law," November and December issues), connect the series condenser in the antenna circuit. Pressing the key, and having a hot wire meter in circuit, adjust the inductance in the secondary circuit until a maximum reading is obtained. Now vary the capacity of the series condenser and repeat, continuing until the maximum reading is obtained. Note the connections and the capacity used for future reference.

2. *Wave Meter.* If you have a wave meter, it will only be necessary to measure the wave length of the secondary circuit with the series condenser connected in. Vary the capacity of the series condenser until a 200 meter wave length is obtained with a desired amount of inductance in the circuit. This may be checked with the hot wire meter to insure the maximum radiation.

Construction of the Series Condenser. The condenser for use with the average aerial will not need a very large capacity. The conditions vary so much in each case that a variable condenser is the most desirable form. The condenser which is described is of such dimensions that it will work well with a large percentage of the average old outfits, and if found too small or large it can readily be altered.

Obtain two identical pieces of ordinary window glass 8 by 10 inches. Coat one side only of each piece, with heavy tin foil or copper sheet as shown at (C), Fig. 1, taking care to make the foil smooth and space as shown. The 2½-inch extension of the foil is for connection. Give each plate a coat of shellac on all surfaces. Now cut out a piece of 1/32 inch fiber sheeting to the dimension and shape shown at (D), Fig. 1. Obtain also a piece of brass or copper sheet cut to the dimensions of 4½ by 8½ inches and smooth off the edges with a file. Now shellac the fiber piecee to the two glass plates so that the blank faces are next to the fiber and the foil surfaces are on the outside. The two plates will then be fastened together with the fiber between them, so that the extensions of the tin foil are at the back and the open part of the U shaped fiber is at the opposite end. This will be clear by referring to (E) and (F), Fig. 1, which are the plan and isometric views of the assembled condenser. The brass sheet is then placed in the recess thus formed so that it can be moved back and forth, thus varying the capacity. The condenser should be mounted so that it is well insulated and heavy flexible conductors should be soldered to both the foil coatings and the brass sheet. The assembled

condenser should be mounted in a vertical position if possible.

Condensers for larger sets can be constructed in the same manner, using thicker glass, larger dimensions and having the fiber cut larger than the glass plates, to form a flange. The capacity for use with medium sizes of aerials may be larger than for larger aerials. There is a practical limit which will soon be found by experiment. It is well to start with all of the capacity and then to reduce the capacity by pulling out the brass plate until the desired position is found.

SHORT AERIALS.

In the remainder of this chapter, we will be concerned particularly with 200 meter sets operating with short aerials. As has already been pointed out in this chapter, the total length of the aerial should not exceed 120 feet. Inasmuch as lead-ins

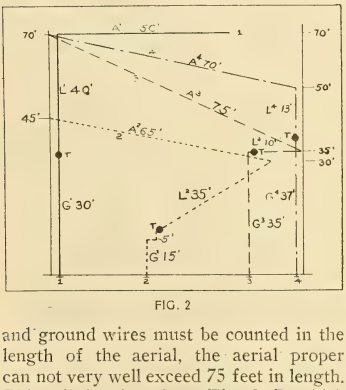


FIG. 2

and ground wires must be counted in the length of the aerial, the aerial proper can not very well exceed 75 feet in length. This will be clear from Fig. 2, in which four cases are shown. The aerials in this illustration are indicated by the numerals (1), (2), (3) and (4) and are shown as simple distinct lines to indicate the length and arrangement of the parts. Thus, (A^1) 50 feet means that the aerial (1) proper is 50 feet long. (L^2) 35 feet means that the lead-in of aerial (2) is 35 feet. And (G^3) 35 feet means that the distance from the instruments to the ground is 35 feet for aerial (3). The black circles (T) indicate the positions of the sending instruments.

Aerial (1) indicates a horizontal aerial 50 feet long and suspended 70 feet high. In order to use such a high aerial, it is necessary to make it this length, and to have the ground lead and lead-in substantially in a straight line, if the total length is to be kept within the limit.

The aerial (2) is 45 feet high at one end, 30 feet at the other, and is 65 feet long. The lead-in is 35 feet and the instruments are about seventeen feet up from the ground. It will be noted that a bend is indicated in the ground lead, which amounts to about five feet extra. This is a typical case and usually occurs when the water pipes are used for grounding.

Coming now to aerial (3) we see how a 75 foot aerial can be used with a short lead taken from the lower end, to keep within the limit. In this case, the instruments are 35 feet from the ground so that the ground wire must be substantially straight. Aerial (4) needs no special comment, and shows how an aerial 70 feet long may be used if the leads are made substantially straight.

Whatever modification a particular case may require, the total length should be kept within the 120 foot limit. To take a special case, suppose that it is possible to have two aerial supports, one of which is 61 feet high and the other 39 feet. Suppose it is found that the instruments can be located in a room 27 feet up from the ground and situated near the 39 foot aerial support. This case might readily occur in the average city.

A suitable arrangement complying with these limitations is shown in Fig. 3. Here the aerial proper comprises four conductors 75 feet long of No. 12 copper, or seven strand phosphor bronze wire, spaced two feet apart on the spreaders. The supports can be poles as indicated or extensions on buildings, trees, or other arrangements, it being understood that

the aerial is well insulated. The lead-in consists of four wires of the same capacity as the aerial wires, eighteen feet long and in the form of a rat tail. Each wire is fastened and soldered to one of the antenna wires. The instruments are again indicated by (T) and the ground lead is run straight to a good ground. In this illustration the antenna conductors are shown, turned out of their plane, in order to make

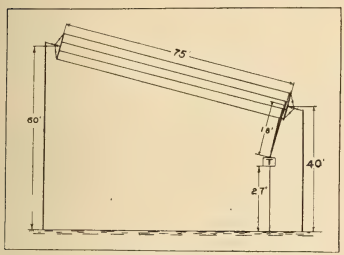


FIG. 3

their appearance clear. It will be noted that the height of the antenna from center to center is 60 feet at one end and 40 feet at the other on account of the slant of the supporting ropes. The fact that a pole is 60 feet high does not always mean that the antenna will be 60 feet high, as is shown in this case.

It should not be difficult to arrange a short aerial to meet the particular conditions for any case. When a larger aerial is already in use, a short aerial can be erected as described, for use with the transmitter only. In such a case it is preferably located at a right angle to the larger aerial. The use of the series condenser, as described, makes the erection of such a short aerial unnecessary. Simple aerials with direct leads are to be preferred for short wave lengths because they aid efficient radiation and sharp tuning at the low wave length. An aerial which takes all sorts of twists and bends should be avoided.

GROUND CONNECTIONS.

With a low wave length, a good ground becomes even more important than heretofore. It is not considered necessary to go into the details of the various forms of grounds other than to point out the need for good connections. Make the ground lead as short and direct as possible. Remember that every foot saved in this part of the aerial can be put to use in the antenna and that every foot wasted means another limitation to the wave length, which can be alloted to the remainder of the circuit. Every twist and turn should be avoided if possible. If connection is made to the water pipes, be sure that it is a connection, and solder it well. Remember too that it will not aid your effort to secure a short wave length to have your ground circuit run through all of the house pipes before it reaches the ground. The use of wire smaller than No. 8 B. & S. is not desirable. It is not good policy to choke off the energy by the use of small ground leads.

(To be continued.)

Receiving Stations on the Ground

At the little town of Neuchateau in the Vosges, France, the signals from the Eiffel Tower at Paris, 250 miles away, have been heard by means of horizontal wires placed close to the ground. One of these arrangements consists of a grill formed of nine wires of galvanized iron, five millimeters in diameter and about 65 feet in length, stretched horizontally four inches apart at a distance of three feet above the earth. The extremities of the wires are soldered to two transverse wires and the collector connects with the instruments on the ground floor of the house. When this arrangement is replaced by a metallic grill, the signals are still heard, but not so well. Another receiving station has for antennæ a strip of wire netting of large mesh, 100 feet long and three feet wide, supported at about 20 inches above the earth.

Nine New Wireless Stations for Canada

An announcement has just been received to the effect that the Marconi Wireless Telegraph Company, of Canada, has entered into an agreement with the Canadian Government for nine additional stations in the Great Lakes regions.

The Canadian Marconi Company is to receive an annual subsidy of $31,500 for their operation and maintenance over a period of nineteen years.

Washington Greets Honolulu

The long distance record is broken and wireless telegraphy has achieved another advance. On Sunday evening, December 8th, the new station at Arlington succeeded in getting in communication with Honolulu, nearly 6000 miles away!

C. F. Elwell, chief engineer of the Federal Telegraph Company, was operating at Arlington Station, near Washington, D. C., which has recently been erected by the Government. He had just succeeded in exchanging messages with San Francisco, and was carrying on this 3500 mile aerial conversation, when suddenly he was astounded to hear signals coming from the station at Honolulu.

Completely surprised and hardly believing his senses, Elwell immediately grasped the sending key and flashed the following message to the San Francisco operator:

"Call Honolulu and tell him to listen, for we get him fine. ELWELL."

The operator at San Francisco did so at once; and as soon as he advised Elwell that Honolulu was ready, the latter flung these words into space:

"This is C. F. Elwell at Arlington near Washington. How do you get us. We get you!"

Immediately on dispatching this message Elwell pressed the receivers to his ears, and breathlessly awaited a response. Very soon he caught the faint tick of an incoming signal, and while rather inclined toward the feeling that what he hoped for was impossible, he commenced to tune his instruments until finally the sounds came in quite steady and clear; and he experienced the amazement and delight to hear the following from far off Hawaii:

"If this is surely Arlington I hear you O. K., but I can't believe it. This is S. B. Maddams. Give C. F. Elwell my regards and tell him that we launched a yacht here today, named the C. F. Elwell. You come pretty good. Go ahead and give O. K."

For a moment Elwell stood still, full of wonder at the remarkable thing that had just taken place; then he again seized the sending key and flashed these words in reply:

"S. B. Maddams, Honolulu: Thanks Maddams. Will be at 2, our time, tomorrow with Chicago and Kansas City. Good night. C. F. ELWELL."

Thus was achieved a success for the Government's new wireless station at Arlington that was hardly anticipated when this immense structure was projected.

The news of this great accomplishment was immediately sent to all the stations of the Federal Telegraph Company in various parts of the United States. When H. P. Veeder of San Francisco, who is secretary and treasurer of the company, heard of this he immediately communicated direct with Honolulu to verify the announcement from the East. Operator Maddams at Honolulu at once forwarded him an answer, in which he recited the details of this memorable event and added that the messages from Washington "came clear and fairly loud."

This notable feat marks another great record in the wireless transmission of messages, and more firmly establishes this wonderful art as a necessary adjunct of our civilization.—W. ZACHERT.

THE UNIVERSAL HOUR

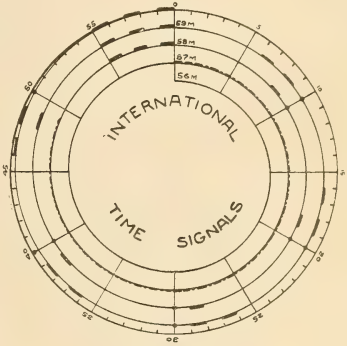
The International Time Conference which was held in Paris in October last has agreed to the acceptance of Greenwich time as the basis upon which the proposed international time signals are to be sent out. Since March, 1911, French legal time has been that of the meridian of Greenwich; previous to that it had been the mean astronomical time at the meridian of Paris. The difference is 9 minutes and 21 seconds. Consequently, Greenwich time will be given from the following wireless stations, if the recommendations of the conference are carried out, at the hours indicated, on and after July 1, when they are expected to be ready for this service:

Paris—10 a. m. and midnight; Mogadiscio (Italian Somali)—4 a. m.; San Fernando (Brazil)—2 a. m. and 4 p. m.; Arlington (U. S.)—3 a. m. and 5 p. m.; Norddeich (Germany)—12 m. and 10 p. m.; Massua (Red Sea)—6 p. m.; San Francisco—8 p. m.

The signals will be given according to the code shown by the diagram, beginning two minutes before the hour:

From 57 minutes to 57 minutes 50 seconds—warning signals; from 57 minutes 55 seconds to 60 minutes—time signals.

The advantage of this system to all ships carrying wireless apparatus will be apparent. Now a ship's officer must depend upon the accuracy of his chronometer in determining his location; the chronometer may not have been compared with standard time for days or even weeks, and an error of a fraction of a minute will falsify this reckoning by miles. With the new system he will never be out of range of some time signal for more than a few days at a time. It is thought that these signals may also



TIME SIGNAL CODE

be used to give warning of the location of icebergs, and it is proposed to extend our present knowledge of meteorology by the exchange of weather reports between the different stations. The conference also appointed a commission to arrange for an organization for the scientific study of the Hertzian waves in their relation to the surrounding media.

The Increased Cost of Living in France

La Revue Electrique gives in a recent number a calculation by which it comes to the conclusion that the law passed in March last year, making Greenwich time the legal time for the whole country, has increased the lighting expenses of every household in France by about 1%. Without considering the accuracy of this figure, it is very evident that the cost of electric light, kerosene and candles will be increased somewhat when people stay up o'nights ten minutes longer than they have been doing, as will undoubtedly be the result of putting back the clock ten minutes, seeing that all household and business affairs are regulated, consciously or unconsciously, by the clock.

For Practical Electrical Workers

Telephone Wiring

By GEO. MADISON

Telephone wires run in pairs, the wires of which are designated as "tip and ring," "odd and even" or "line and test." The tip wire is usually the darker insulated of the two. The idea of having differently colored insulation on the two wires of a pair is to simplify the location of a case of trouble, inasmuch as the wires if cut must be spliced back exactly as they were. In outside wires and in inside wires outside of cables, the wires are designated by the use of a silk thread which runs through the insulation on one wire and not on the other.

The ring wire should always be fastened to the right hand binding post in all telephone terminals, except instrument terminals, and the tip wire should be fastened to the left hand post. If, however, a single row of posts is mounted vertically, then the even numbered posts counting from the top down should be the ring side while the odd numbered posts become the tip side. If the connecting blocks are mounted horizontally and numbered from left to right the lower posts become the tip side, but if the blocks are numbered from right to left the upper binding posts become the tip. Like wires should always be spliced or bridged to like wires and reversals of the circuit thereby avoided.

All wires should pass through the entering rings and through the proper hole in the terminal box before being connected to the terminal. The insulation should be removed and the wires scraped clean, care being exercised that the wire be not nicked. Wires should be made fast with one complete turn around the binding post in the direction in which the nut tightens and the ends should not lap. The distance from the binding post to the insulation on the wire should not be less than 1-16 nor more than ⅛ of an inch. The binding post nuts should be tightened with a regular binding post wrench and not with pliers, shears, etc.

When connecting a wire to a binding post having only one washer between the nuts, the first wire should be placed under the washer, the second over the washer and a third wire may be attached by placing it under the washer and alongside of the first wire, but the wires must lie flat and not lap each other. When the binding post has two washers between the nuts, the first wire should be placed between the washers, the second under the lower washer, while the third wire is placed above the upper washer.

When splicing outside insulated wire, the splice should be made by the use of a copper sleeve. The insulation should be removed for about four inches from the ends of the wire, the wire scraped nice and clean and inserted into the sleeve so that the insulation is tight against it, as in Fig. 1.

Table 1 compiled for the use of the New York Telephone Company, gives the proper size of sleeve to be used, the number of half turns to be given and whether or not the splice is to be taped. All splices in twisted pairs should be

staggered so that the ends of the joints will miss each other by at least six inches.

The splices in inside wires may be made by either twisting the wires into a Western Union joint and soldering or by means of a copper sleeve. In places where a flame might be dangerous the twisted joint may be tightly wrapped with tinfoil instead of soldering. In splicing a twisted pair, care should be taken to have the strain equally divided between the wires and this is accomplished by keeping both wires exactly the same length. Inside wires should not be spliced between the instrument and picture molding or baseboard in new work, and should never be spliced under floors, in damp places, or in terminal boxes. When the wires are spliced in a shop or storeroom, the wires should be twisted and soldered together.

When making a twisted joint on inside wires the insulation should be removed for about four inches from the ends of the wires without nicking them, and the wire scraped clean. A joint of eight half turns should be made and the wire then given eight half turns around the insulation, after which the ends should be trimmed close and pressed into the insulation. The wire should not be exposed for over an inch, after the splice is made, and the joint should be soldered and covered with two layers of pure rubber tape and two layers of friction tape, Fig. 2.

Fig. 3 shows the correct method of splicing a twisted pair to bare line wires on a terminal pole.

When one pair of wires is to be bridged to another, as in Fig. 4, the slot in the base of the connector is slipped over the main line wire and the bridging wire connected in the manner described for fastening a wire to a binding post. If a second No. 18 B. & S. twisted pair wire is to be bridged at the same point it should be placed above the top washer. Additional connections may be made by using two washers, Fig. 4.

A general method of running inside wires is as follows: The inside wire should be run as inconspicuously as possible and should never come in contact with finely finished walls and woodwork.

TABLE I.—SPLICING.

Sleeve, B. & S. Guage	Length	Size and Kind of Wire Spliced	No. of ½ Turns	Taped
6	6¾	Connecting No. 8 B. W. G. bare wire	7	No.
6	6⅜	Dead ending No. 8 B. W. G. bare wire (½ sleeve)	3	No.
12	4¾	Connecting No. 12 & 14 N. B. S. bare wire	8	No.
10 14	3	Connecting No. 12 N. B. S. bare to No. 14 B. & S. two pair wire	5	No.
10 18	3	Connecting No. 12 N. B. S. bare to No. 18 B. & S. two pair wire	5	No.
16 18	3	Connecting single No. 12 B. & S. covered to No. 18 B. & S. two pair wire	5	Yes.
12	4½	Connecting No. 14 N. B. S. bare wire	8	No.
12	2¼	Dead ending No. 14 N. B. S. bare (½ sleeve)	3	No.
12 14	3	Connecting No. 14 N. B. S. bare to No. 14 B. & S. two pair wire	5	No.
12 18	3	Connecting No. 14 N. B. S. bare to No. 18 B. & S. two pair wire	5	No.
14	3	Connecting No. 14 B. & S. two pair to No. 14 B. & S. two pair wire	5	Yes.
14 16	3	Connecting No. 14 B. & S. two pair to No. 16 B. & S. leading in	5	Yes.
14 18	3	Connecting No. 14 B. & S. two pair to No. 18 B. & S. two pair wire	5	Yes.
18 19	1½	Connecting No. 18 B. & S. two pair to No. 19 B. & S. two pair inside	2	Yes.
19 19	1½	Connecting No. 19 B. & S. inside to No. 19 B. & S. inside	2	Yes.
10	4¾	Connecting No. 12 N. B. S. bare wire (½ sleeve)	8	No.
10	2⅜	Dead ending No. 12 N. B. S. bare wire	3	No.

pipes or electric conduit. It is quite common, however, to have provisions made for the telephone wires at the time the building or house is constructed. These

Fig. 1

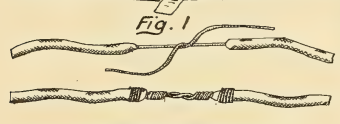


Fig 2

provisions usually take the form of some sort of conduit, often similar to regular electric conduit, or a molding, or a combination of both conduit and molding. The former method is best and as there are often no special wiring facilities provided, we will consider that the building has none, in which event the wires should preferably follow the picture molding, or, if no molding is available, the wires could be fastened to the baseboard but the woodwork should not be damaged. Wires should never be run along chair rails as there they would be directly exposed to mechanical injury.

The greatest damage done in inside wiring is in boring holes through walls or ceilings and extreme care should be used when doing this class of work in order to avoid interference with sliding doors, windows, etc., as well as to avoid damage to the opposite side of the partition or wall.

When the instrument is located on a desk which stands out from the wall, the wires should be brought out under the floor if possible, but if the wire must be laid on top of the floor it should be covered with a molding so as to avoid not only damage to the wire but also the possibility of accidents from tripping over it. A small coil of slack wire should be left behind the desk or table, so that it may be moved without breaking the wires. It is often required that the wires be run under rugs, carpets, etc., and special treatment is necessary in nearly every case, but one thing holds good for all jobs in which carpets play a part, and that is never to cut holes in rugs or carpets in order to bring the wires through, but bring them through by separating the threads at the seam by means of a sharp pointed lead pencil or a sharp piece of wood.

Inside wires may be fastened with furniture nails, cleats, double pointed tacks, tie wires, clamps, or rings. Furniture nails may be used for fastening wires to woodwork and plaster walls using the shorter ½ inch for hardwood and the longer one inch for softwood and plaster. Nails and tacks should never be used for outside wiring on metal walls, around window sills or in other damp places and when used on interior work should not be spaced more than twelve

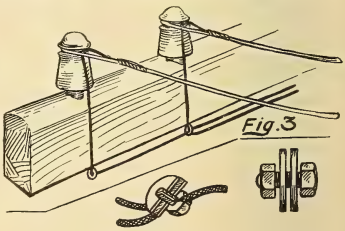


Fig.3

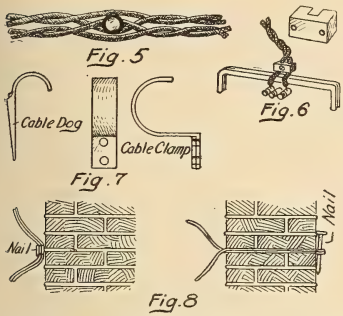
Fig.4

inches apart except when the wires are run in molding, when the nails may be spaced eighteen inches apart. When rounding inside corners the nails should be placed ½ inch on either side and the wire bent back into place in the corner. Two pairs of wires may be fastened by one nail, as shown in Fig. 5.

When fastening wires around window

sills, to metal or to damp walls, a two or three wire cleat should always be used. A cleat should always be used to fasten wires near the binding posts, as shown in Fig. 6.

Double pointed tacks may be used for



fastening a single wire and sometimes for a twisted pair, but when used in connection with the latter both wires should never be placed under one tack.

When lead covered switchboard cable or inside wire taped in the form of a cable is used, it should be fastened with clamps as shown in Fig. 7, or by annealed iron wire and cut nails, Fig. 8. If cable clamps are used Table II will be of assistance in determining the size of the clamp, screw and anchor to be used.

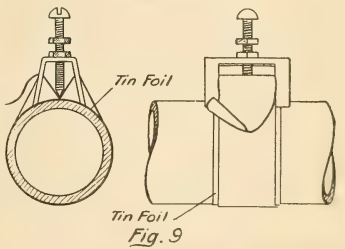
TABLE II.—FOR 22 GAUGE SWITCHBOARD LEAD COVERED CABLE.

Prs.	Diam. in Ins.	Size Clamp	Size Anchor	Size Screw
5	3/8	00000	No. 10, 3/4 in.	No. 10, 1 in.
10	13/32	0000	" 10, 3/4 "	" 10, 1 "
15	1/2	000	" 10, 3/4 "	" 10, 1 "
20	9/16	00	" 10, 3/4 "	" 10, 1 "
25	5/8	0	" 14, 1 "	" 14, 1 1/2 "
30	11/16	1	" 14, 1 "	" 14, 1 1/2 "
40	3/4	1	" 14, 1 "	" 14, 1 1/2 "
50	13/16	1	" 14, 1 "	" 14, 1 1/2 "
60	29/32	2A	" 14, 1 "	" 14, 1 1/2 "
75	1	2	" 14, 1 "	" 14, 1 1/2 "
100	1 1/8	2	" 14, 1 "	" 14, 1 1/2 "
150	1 11/32	3	" 14, 1 1/2 "	" 14, 2 "
200	1 1/2	3	" 14, 1 1/2 "	" 14, 2 "

When running several pairs of wires in light or air shafts, loft buildings, cellars, factories, stables, etc., where their appearance is not objectionable, rings may be used.

When inside wiring comes in contact with pipes or passes through floors or plaster walls, and whenever necessary to protect against mechanical injury, the wires should be well taped. Tape may also be used to change the color of the insulation on the wires and make it harmonize with the color scheme of the walls and molding with which it comes in contact. Cloth tape in various colors may be used for this class of work.

When entering a building with No. 18 wire a 3/8 inch hole should be bored for one pair of wires, a 1/2 inch hole for two pairs of wires and a 5/8 inch hole for three pairs of wires. These holes should be well reamed out and slant downward from the inside. In brick buildings the wires are generally led in through the frames of windows or doors and it is preferable to locate them at the top of the frame rather than below. In frame buildings, the holes should be bored through the wood apron under the window sill or through the outside base immediately above the foundation walls. The wires should pass through the hole without untwisting, binding or kinking



and at the point of entrance they should be wrapped with friction tape for a distance of about two inches and in such a manner as to form a conical wrapping about the wire and having a diameter in the center a little larger than the hole and tapering each way. The wire should be drawn into the hole until this wrapping

enters and completely plugs up the opening. The wires should then be fastened below the hole and as close as possible to it.

Ground connections for party line bells, battery feeders, etc., may be made to water pipes, cable sheaths, gas pipes or to a buried ground, the preference

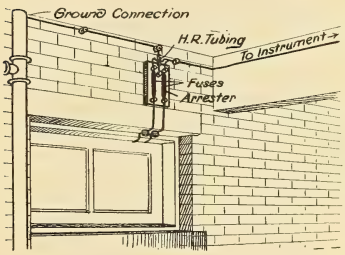


Fig. 10

being given in the order named. Steam, hot water or sprinkler pipes should never be used for grounds. All grounds should be made as near to the point of entrance to the building as possible and all attachments should be made in an accessible place and so located that the wires will not be disturbed. When attaching to a gas pipe the connection should be made on the street side of the meter. The best practice for attaching wires to pipes, cables, etc., is to file up the surface if an iron pipe, scrape a cable sheath and sandpaper a galvanized pipe, then wrap the pipe or cable with tinfoil. A ground clamp, Fig. 9, is then attached and, if the connection is exposed to the weather, the entire device is taped.

Wires must not come nearer than two inches to any light or power wires in a building unless separated by some continuous non-conductor such as porcelain tubing or approved flexible tubing.

When the telephone wires run in proximity to high voltage electrical circuits the separation should not be less than one foot. If absolutely impossible to obtain this separation between the two circuits, the telephone wires should be enclosed in an approved insulating tubing and the greatest clearance possible secured between the two circuits, but under no circumstances should the covering of the high voltage circuit and the insulating tubing on the telephone wires touch each other. The insulating tubing should project six inches on each side of the high voltage conductor and should be securely taped at each end.

When protectors are used they should be placed within the building and as near the entrance of the line wires as possible, allowance being made for an easily accessible ground and for convenience in inspecting and repairing. The protector should be at least six inches from probable contact with curtains, shades or other inflammable material and should be securely fastened to the support with its fuses vertical and so that the line

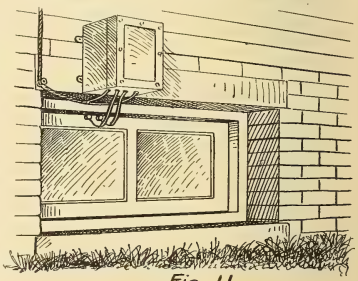


Fig. 11

wires may connect directly to the binding posts. The protector should be mounted so that the binding posts are either at the top or at the bottom but the micas should always be placed with the notched side down. The protector should never be placed in a show window, on vibrating partitions, or on damp walls. Fig. 10 shows the usual installation of a protector on the inside of the cellar wall over a window. It is sometimes impracticable to place the protector within the building, in which case it should be

mounted in a cast iron waterproof box as shown in Fig. 11. Fig. 12 shows the position of the protector in the box. This box should be located on the outside of the building in a position accessible for inspection and repairs and as near as possible to the point of entrance. When protected lines enter a building they should enter in the same manner as given in the early part of this article for unprotected lines, but the holes should be bored 2½ inches apart and bushed with insulating bushings, usually made of porcelain.

The ground wire should be No. 16 B. & S. insulated wire, which should be attached to the post on the protector marked "G" and should be run as straight as possible from the protector to the ground, using a two piece porcelain knob as shown in Fig. 13. In places where these knobs would be unsightly the ground wire may be run on "peanut" cleats as shown in Fig. 14. The knobs and cleats should be placed not more than four feet apart and when passing through walls or floors the ground wire should be run through cir-

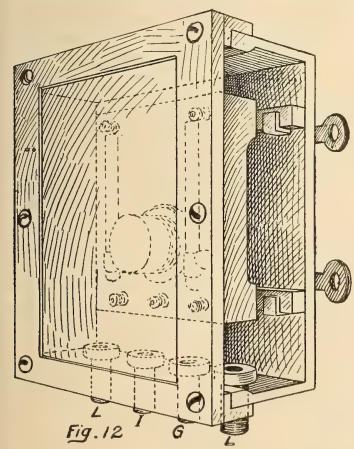


Fig. 12

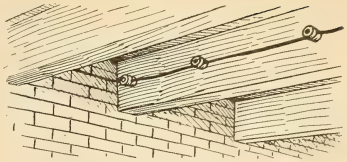


Fig. 13

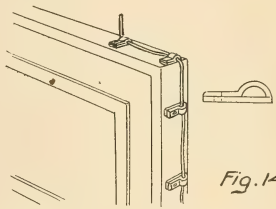


Fig. 14

cular loom or insulating tubing. When installing party line instruments a triple conductor wire should be run between the protector and instrument so as to provide a ground wire for the bell.

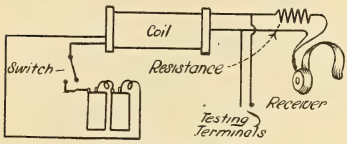
The outer covering of the switchboard cable should be carefully removed only as far as necessary to permit of properly forming the cable without damaging the insulation or conductors. The strippers of unfilled cable and one inch of the outer covering should be immersed in hot standard beeswax compound for three minutes and the surplus wax allowed to drip off before cooling. Standard beeswax is a composition composed of half beeswax and half paraffine.

For cotton covered cable the butt should be wrapped with waxed twine for ½ inch over the strippers, starting at the end of the outer covering. The twine should be wrapped back on itself and extended a distance of ½ inch back of the starting point. One end of the twine should be pulled in under the wrapping and the other or long end should be used for sewing the form. After cables have been formed up and sewed they should be shellacked and baked until all moisture is expelled.

Fault Finder

The fault finder here described will give good service in testing knob and tube work, conduit systems and fixtures, for grounds, short circuits, etc.

Make a hardwood box 10 by 8 by 3½ inches having a hinged cover with latch



FAULT FINDER.

or lock. Purchase a small induction coil (one giving a 1-32 inch spark is large enough), four binding posts, eleven ounces of No. 36 enameled copper magnet wire, a small battery switch, a head receiver and cord and two testing terminal wires.

The next step is to mount the articles in and on the box. The two batteries should be securely fastened in the box by wrapping them with strong wire, then securing the wire to the back of the box with wood screws. The coil should be placed where adjustment will not be difficult. The No. 36 magnet wire wound on a piece of fiber should provide resistance for the receiver and be connected to the apparatus as shown in the diagram. The four binding posts are installed on the box to serve as testing and receiver cord terminals.

In testing for a short circuit a humming sound will be detected in the telephone receiver. Should the coil or wire being tested be of higher resistance than the resistance in series with the receiver the apparatus will prove useless. If the test is being made for an open, the rule should be reversed; that is, the noise in the receivers will be detected upon locating the defective coil. In testing for a ground, apply the rule for detecting a short.

By placing a leather handle on the instrument it may be easily carried from place to place. Take care that it receives no jars as this will make necessary the adjusting of the vibrator on the coil, but if a lock nut is placed on the stationary portion of the vibrator this trouble will be eliminated.—P. M. Eames.

Why Shunt Motors Speed Up

Most repair men are familiar with the fact that a weakened field or a decreased number of armature coils will result in increased armature speed but the reason of this phenomenon may not be so generally known. First let us state certain facts that are more or less self-evident, or that follow directly from Ohm's law. The current through any circuit is equal to the effective voltage divided by the resistance, the effective voltage being the applied voltage less any opposing voltage that may be present. Also the torque or twisting force of a motor is proportional to the armature current, which in the case of a motor will be the difference between the line voltage and the motor voltage divided by the armature resistance. This last point will become clear if we consider the fact that the motor is essentially the same as a generator and will generate a voltage proportional to its speed and field strength. Therefore the effective voltage is not the line voltage but the difference between it and this counter electro-motive force, as it is called.

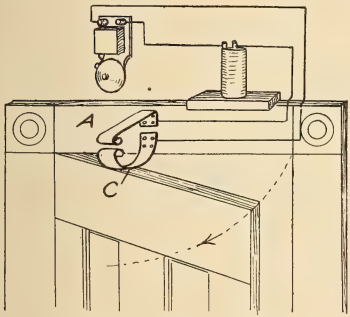
Bearing these facts in mind let us consider the probable effect of a weakened field. Since the motor voltage or counter e. m. f. depends on the field strength the former will be reduced and the difference between it and the line voltage will become greater. As this difference is the effective voltage tending to send a current through the armature the current will be increased and the torque will also be increased. Thus we see that weakening the field indirectly tends to increase the torque and speed also, since increased torque will naturally cause increased speed.

The increased speed will partly compensate the weakened field and raise the motor voltage almost to its original value, so that the motor will strike a balance at a slightly higher speed than the original one. Since the motor voltage depends on the number of coils this same phenomenon attends the cutting out of armature coils.—T. G. SEIDELL.

Office Bell

In offices of doctors and dentists where there is no attendant and in other rooms where the noise of machinery prevents the opening of the door from being heard, a bell connection as in the following description may be used.

Two pieces of tin (A) and (C) are



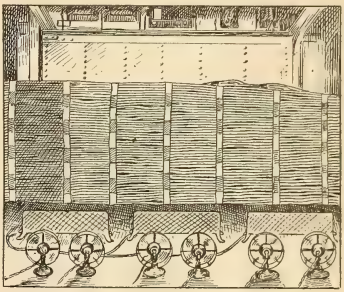
DOOR CONTACT FOR OFFICE BELL

fastened by nails or screws to the door frame and under each is secured the bare end of a bell wire, which connects as shown to a bell and battery. The tin strips may be an inch wide and five or six inches long. Brass may be used in place of tin if desired.

By shaping the strips as indicated, the top of the door strikes the lower tin closing the circuit for only a moment. As the door opens farther, the strips spring apart breaking the circuit automatically. —W. H. ALBRIGHT.

Drying Telephone Cables

During a recent fire in a telephone exchange the water thrown saturated the cables at the back of the switchboard. To dry these out electric car heaters

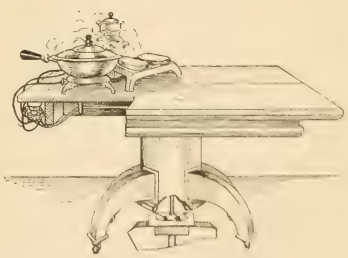


ONE WAY OF DRYING TELEPHONE CABLES

were borrowed from the car company and the heat generated by them blown upon the cables by electric fans as shown. This was considered to be the only feasible means, as great care had to be exercised to prevent the melting of the paraffin used in the cable insulation.

Dining Table Outlets

In these days of numerous electrical cooking devices, such as percolators, toasters, etc., designed for use on the dining table, it is often a question of where to obtain the necessary circuit



ARRANGEMENT OF TABLE OUTLETS

connection, when several devices are used at the same time. Unsightly cord runs are objectionable.

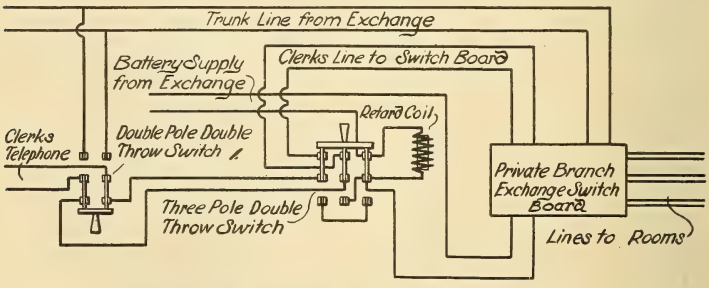
In one case convenience was found in the following manner: In the center of the dining room floor under the table a flush wall plug receptacle was fitted and connected to a circuit run on the basement ceiling from the service. From this receptacle a No. 14 reinforced portable cord equipped with a plug and long enough to allow for the extension of the table was passed through the hollow center leg and then to a 600 watt, wall socket located under the table edge. Into the wall socket was screwed a three outlet fixture for the reception of the heater circuit plugs. When cleaning is done or the table moved the floor cord and plug are pulled out through a slit in the carpet.

Hotel Clerk's Private Exchange Board

In a hotel having a private branch exchange using direct current telephones, i. e., transmitter and receiver in series, the switchboard is located behind the cigar counter entirely across the lobby from the clerk's desk.

When the operator leaves at night she turns on the night alarm and throws the three pole, double throw switch shown in the accompanying diagram, which allows sufficient current to flow through the clerk's instrument to enable him to ascertain the wants of any guest who may call him after that time. He can see the switchboard from his location and if it is the trunk line from the city exchange which is flashing he throws the double pole, double throw switch shown and places himself directly on the trunk.

Of course if one guest desires to talk to another or to a party in the exchange the clerk must go and put up the connection, but as a majority of the calls are for ice water or of that nature he saves many unnecessary steps.—MAURICE E. YOUNG.



CIRCUITS OF THE TELEPHONE CLERK'S PRIVATE EXCHANGE BOARD

How Brass for Fixtures is Made

A young man, newly employed as clerk in the office of a brass mill, remarked to a fellow clerk, "I see invoices for the copper, zinc and other stuff, but where do they buy the brass?"

While this may be an exceptional case, yet the general idea of brass, outside of manufacturers and dealers in it, is rather vague. The two most important products of this industry are sheet brass and tubing.

The brass industry had its inception about a century ago in and around Waterbury, Conn. Dame Fashion gave rise to the need of button shops, for the gentlemen of that day were adorned with bright metal buttons on coats and buckles on shoes, and Yankee shrewdness and

energy answered the demand with little mills along the streams that abounded in this section, for manufacturing them. And from that beginning the value of the brass industry's output has reached a total of $200,000,000 annually.

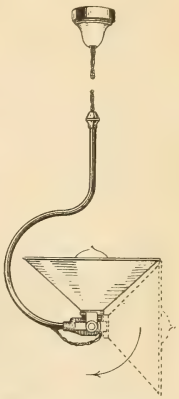
Brass is an alloy of copper and zinc in certain proportions, about two parts copper to one of zinc being the alloy most used for sheet brass. The metal is melted in crucibles carrying about 200 pounds. First, the copper is placed in the crucibles; when this has reached a fluid state a flux is added, which in casting shop vernacular "cleans the metal." The melted copper is then covered with a layer of charcoal, to prevent oxidation, by keeping the air from contact with the molten metal—the carbon in the charcoal also acting as a reducing agent. The zinc is next added. After the alloy has been well puddled it is poured into a mould to solidify. If the solid mass shows no imperfections it is sent to the rolling mill, annealed in a furnace in 5,000 pound lots and is then ready for the break-down rolls, two chilled iron rolls 20 inches in diameter and weighing twelve tons. Here, to use a crude illustration it is rolled out as the pie maker rolls crust.

After each annealing the metal is placed in a bath of oil of vitriol (about six per cent) and water and "pickled" clean, removing the surface oxidization which takes place during annealing. By repeated rollings the sheet is reduced to whatever gauge is desired, and after being cleaned in sawdust is inspected and slit to the necessary width, and shipped in coils of about 80 pounds each to be manufactured into the many forms for which brass is used, such as lamp bodies, electrical and gas fixtures, etc.

The tubes used in chandelier work are usually brazed tubes, and are made from sheet brass cut in strips and formed up into tubes, the edges being brazed together in a specially constructed furnace. They are then drawn in a steel die and triblet until the desired diameter and gauge is reached.—*The Fixtureman.*

Combined Direct and Indirect Fixture

A British company has placed upon the market a combined fixture for converting a pendant lamp with a shade into an indirect lighting unit when desired. A tube for the flexible current conducting cord, a grip for holding the lamp by its shade ring and a swivel permitting the lamp and shade to be turned to any position between an upward reflection of the light and a direct downward illumination make up the fixture.

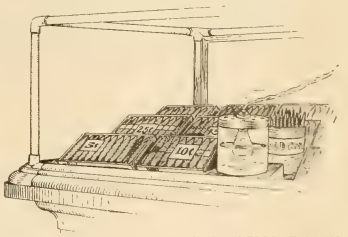


COMBINATION FIXTURE

Tobacco Jar Humidor

A one pound glass tobacco jar may be converted into a practical humidor.

Drill six or eight 3/8 inch holes in the metal top of the jar away from the center and in a circle preferably. At the center cut out a hole large enough to allow a lamp socket to be passed part way through as shown. With the jar two-thirds full of water when the cover and lamp are put in place the heat from the lamp will cause evaporation.



HUMIDOR MADE FROM AN INCANDESCENT LAMP

ELECTRICITY THE SILENT SALESMAN

Some Helpful Hints on the use of Electric Current in getting up Show Window Displays. The following schemes have all been used with remarkable success

The "Winking Willies"

An attention attractor that is as unique as it is ingenious is that which has been installed in one of the show windows of the Manchester, N. H., Traction, Light and Power company. It is distinguished by five "winking willies," who succeed in drawing attention of a great many every day to the merits of the various articles which the commercial department of the company has to offer for sale.

THE "WINKING WILLIES"

The picture accompanying this shows the window in question and its winkers. The sign, "When Willy Winks," the diminutive messenger boys and their flirting oculars, are the distinctive features. The Willies are labeled "M. T. L. & P." and each presides over some article of electric usefulness. These latter are connected with a Donkin cent-hour meter, so called, and with a simple rotary flasher designed and built by the company's electricians and operated in such a manner that every twelve seconds a different article is connected with the meter.

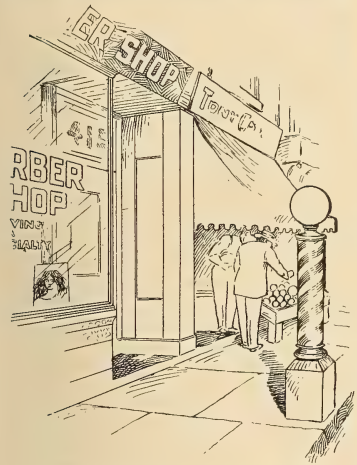
The articles are varied from time to time, but at the time the photograph was taken they were electric toasters, electric flatirons, twin glower, luminous radiator, percolators, etc. As the apparatus connects each article with the cent-hour meter the young man who has it in charge winks in a very pronounced manner in the general direction of the article and simultaneously, on the broad dial of the meter, appears the price in cents per hour at both high and low rates, the charges the traction company makes for furnishing the current to operate it. The connections are so arranged that the current required to operate the winkers does not pass through the meter.

On the face of the meter the low rates, six cents per kilowatt hour, are indicated in red figures, while the high rate, twelve cents, is shown in black. Attention is called to the fact, by means of signs,

that the greater number of Manchester residences are drawing current at the low rate.

Barber Pole as a Lamp Post

A Springfield (Ill.) barber utilizes his barber pole as a pillar to support a light to illuminate the sidewalk in front of his shop. The pole is set on the outer edge



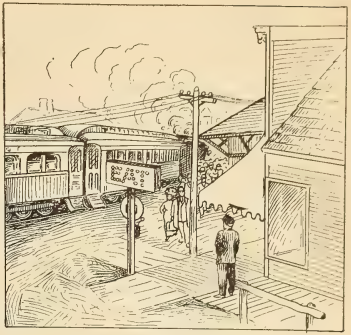
COMBINED BARBER POLE AND LAMP POST

of the walk and is surmounted by a large ground glass globe covering an ordinary incandescent lamp. Wires are run up the center of the post from the basement lighting circuit.

Double Appeal for Customers

An Enid, Okla., restaurant man whose place of business is close to the railroad station uses electricity in two ways upon the outside to call the attention of travelers. Even a blind man can find the place unassisted.

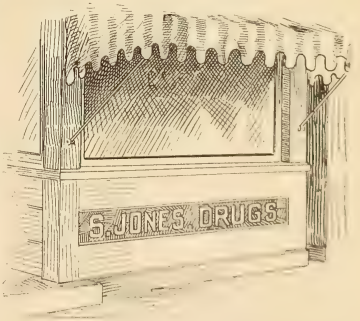
Directly underneath and on the same pole that supports the illuminated sign "EAT," is installed a bell of gong like proportions. Upon the arrival of a train the bell circuit is closed with the result that there are few who do not know that the restaurateur is ready to supply internal needs.



RESTAURANT ADVERTISING

Advertising in Waste Space

In the majority of cases there is an unused space of eighteen to 24 inches beneath the usual store window. A Springfield merchant made advertising space out of this by substituting a translucent glass panel for the wooden one. With his name and wares printed thereon and three incandescent lamps tapped off the basement circuit placed behind, he had a cheap but very effective sign well within the range of vision of pedestrians.



A GOOD PLACE FOR AN ELECTIC SIGN

Electrical Securities

By "CONTANGO"

It is the intention in this article to give additional illustrations of companies, the stock and bonds of which, one or the other, are well worth your consideration and whose statements bring out particular points mentioned in former articles.

American Public Utilities Company.

This company is under the active management of Kelsey, Brewer and Company, engineers and operators of public utility properties, Grand Rapids, Michigan. It controls through stock ownership the public utility situation in the ever growing demands of an ever increasing population.

Capitalization

	Issued	Authorized
Bonds, Thirty-year 5% Collateral Trust	$ 839,000	$20,000,000
Preferred Stock, 6% Cumulative	3,914,000	20,000,000
Common Stock	2,995,000	20,000,000

A conservative estimate, based on previous earnings and a thorough knowledge of the communities served and the operating conditions under which the service is rendered, indicates

Earnings

Gross earnings of all Properties		$2,192,453.31
Operating Expenses, including Taxes and Insurance	$1,140,075.72	
Interest on Underlying Securities	528,475.00	1,668,550.72
Earnings accruing to American Public Utilities Co		523,902.59
Earnings Derived from Working Capital		48,000.00
Gross Earnings American Public Utilities Co		571,902.59
Deduct Interest on $839,000 Collateral Trust Bonds		41,950.00
		529,952.59
Deduct 6% Dividend on Preferred Stock		234,840.00
Earnings on Common Stock less $75,000 thereof held by Trustee for future Corporate purposes		295,112.59
Per cent Earnings on Common Stock		10.1%

following subsidiary companies: Merchants Public Utilities Co., Indianapolis, Ind.; Peoples Light & Heat Co., Indianapolis, Ind.; Elkhart Gas & Fuel Co., Elkhart, Ind.; Valparaiso Lighting Co., Valparaiso, Ind.; Utah Gas & Coke Co., Salt Lake City, Utah; Boise Gas Light & Coke Co., Boise, Idaho; Winona Gas Light & Coke Co., Winona, Minn.; Minnesota-Wisconsin Power Corporation; LaCrosse Gas & Electric Co., LaCrosse, Wis.; Albion Gas Light Co., Albion, Mich.; Holland City Gas Co., Holland, Mich.; Jackson Light & Traction Co., Jackson, Miss. The total population, 1910, of the cities served by this company is given as 471,451 compared with 332,920 for the year 1900. This is an increase of 41 per cent and very aptly brings out the inherent strength of the the following earnings for the present year.

The earnings accruing to the American Public Utilities Company are two and one-quarter times the amount required to pay six per cent upon the company's preferred stock. In a recent offer of $2,200,000 six per cent cumulative preferred stock and $770,000 common stock, $1,000 par value preferred and $350 value common stock were allotted to the $1,000 subscription. At the beginning of the year American Public Utilities common was quoted 64 to 67½ and the preferred at 78 to 80.

Republic Railway and Light Company.

The Republic Railway and Light Company was incorporated in June of last

year in New Jersey and has acquired over 90 per cent of the outstanding stocks of 27 minor companies. The company operates (under satisfactory franchises) about 150 miles of electric railway lines and three electric light and power plants, also three gas plants. In all a population of over 200,000 is served, the increase in this population since 1900 being 64 per cent.

CAPITALIZATION

	Authorized	Issued
Preferred Stock, 6% Cumulative	10,000,000	$5,200,000
Common Stock	7,500,000	6,360,000

The Republic Railway and Light Company has no bonded indebtedness. But the subsidiaries have outstanding bonds amounting to $10,148,000.

The subjoined shows the consolidated statement of earnings for the subsidiary companies for the nine months of the fiscal year ended September 30, 1911, with comparative earnings of the same companies in 1910:

EARNINGS

	1911.	1910.	Increase
Gross	$1,705,105	$1,623,172	5.05%
Operating Expenses	975,839	945,118	3.25%
Net	729,266	678,054	7.55%

The surplus earnings over operating expenses and interest requirements for the three years ended December 31, 1910, and conservatively estimated figures for the following three years have been as follows:

Year	Surplus	Year	Estimated Surplus
1908	$163,156	1911	$488,128
1909	375,916	1912	562,633
1910	445,688	1913	641,883

Regular six per cent dividends are being paid on the preferred stock, the present earnings averaging one and one-half times the amount required for the preferred dividend. The preferred has been quoted at 81 to 82¼, which gives a yield on the purchase at that price of 7.29 per cent. The common is quoted at 25 to 27.

As is the case with other consolidated holding and operating companies, savings and economies are expected by reason of the saving in the cost of power production, better distribution of the power load, double tracking of congested lines, improvement in buildings, standardization of equipment, greater efficiency of employes and the like.

COMMONWEALTH POWER, RAILWAY AND LIGHT COMPANY.

This company was incorporated in February, 1910, with no bonded indebtedness except such as remains upon the individual properties. Through its constituent companies it owns and operates, in the State of Michigan, street railway properties in Grand Rapids, Saginaw and Bay City, together with an interurban line connecting the two last named points and having a total trackage of 121 miles; the gas properties in Jackson, Kalamazoo, Pontiac, Flint, Saginaw and Bay City; the electric light and power companies in Grand Rapids, Muskegon, Lansing, Kalamazoo, Battle Creek, Jackson, Pontiac, Flint, Saginaw, Bay City, Charlotte, Owosso, Corunna, Big Rapids, Albion, Cadillac and many smaller towns; the water business in Cadillac.

The company also controls valuable hydro-electric plants upon the Muskegon, Kalamazoo and Grand rivers; undeveloped waterpowers capable of an installation capacity of 65,000 horsepower on the Au Sable River, and large undeveloped waterpowers on the Muskegon River. The total population served is about 500,000.

CAPITAL

Preferred Stock (6% Cumulative) authorized and issued	$ 6,000,000
Common Stock	12,000,000

Shares $100 par. Preferred dividends payable February 1, May 1, August 1, and November 1.

Figures available showing the combined earnings of the Commonwealth Power, Railway and Light Company and its constituent companies for the eleven months ended November 30, 1912, and the final estimates for 1912 are as follows:

EARNINGS STATEMENT

For eleven months ended November 30, 1912, and estimated for twelve months ended December 31, 1912, with the percent increase over corresponding eleven and twelve months of preceding year, respectively:

	11 Months	Per Cent Increase	12 Months (est.)	Per Cent Increase
Gross Earnings	$5,739,477.26	15.50	$6,289,998.33	15.18
Operating Expenses	3,024,405.78	16.33	3,311,916.02	15.61
Net Earnings	2,715,071.48	14.60	2,978,082.33	14.72
Fixed Charges (see note)	1,688,232.60	19.67	1,827,409.30	19.44
Net Profits	1,026,838.88	7.13	1,150,673.03	7.94
Dividend Preferred Stock	330,000.00	...	360,000.00	...
Balance: Available for replacements and dividends on Common Stock	696,838.88	10.88	790,673.03	12.00

NOTE.—Fixed charges include dividends on outstanding preferred stocks of constituent companies in addition to taxes and interest.

The final estimated figures for 1912 are well within the results shown the year previous. The preferred stock was quoted at 89 to 90 at the close of 1912 which shows a yield of 6.59 per cent. The common stock is quoted at 67 to 68.

It may be mentioned here that the president of this company is Anton G. Hodenpyl of Hodenpyl, Walbridge and Company, the New York bankers. Mr. Hodenpyl was formerly secretary of the Michigan Trust Company of Grand Rapids, Michigan and is decidedly familiar with conditions in the territory served.

EASTERN PENNSYLVANIA POWER COMPANY

The Eastern Pennsylvania Power Company does all the commercial electric light and power business in and about Easton and Bangor, Pa., and Philipsburg and Dover, N. J., serving a population of about 92,000. Through ownership of all the capital stock, the Easton Pennsylvania Power Company controls the Easton Gas Works which does all the gas business of Easton and Philipsburg.

CAPITAL

Capital Stock: (Shares $100 par)	Authorized	Outstanding
Preferred, 7% cumulative	$1,000,000	$ 550,000
Common	3,500,000	2,900,000
Funded Debt:		
First and Refunding Mortgage 5's, due 1939	4,000,000	1,880,000
Easton Power Company 5's, due 1940	120,000	120,000
Bernards Electric Company 5's, due 1971	125,000	125,000
Five Year 6% Notes due 1917, secured by Mortgage	1,500,000	1,000,000

The issue of five year six per cent notes is a direct obligation of the Eastern Pennsylvania Power Company and is secured by a joint mortgage of the Eastern Pennsylvania Power Company and the Easton Gas Works upon all the electric lighting and power and gas properties of these companies in the State of Pennsylvania and further secured by $140,000 mortgage bonds on the gas properties in New Jersey.

H. M. Byllesby and Company, consulting engineers, estimated that on December 31, 1912, the company would be on an annual net earning basis of over $320,000.

EARNINGS

	1910	1911
Gross Earnings, from all sources	$472,394.65	$519,726.61
Operating Expenses, including taxes, maintenance, rentals, and interest on Bernard's Electric 5's	287,366.24	314,066.64
Net Earnings	$185,028.41	$205,659.97
Add saving that will be effected in operating expenses through consolidation (report of H. M. Byllesby & Co.)		44,000.00
Total Net Earnings		$249,659.97
Interest Deductions:		
Bonds, $2,000,000 at 5%		100,000.00
Surplus		$149,000.00
5-Year 6% Construction and Purchase Money Notes $1,000,000 at 6%		60,000.00
Surplus		$ 89,000.00

List of Selected Bonds showing Income Yield

Under the above heading, from month to month, a list of carefully selected securities will be given showing the approximate income yield. In this connection it is to be remembered that the income yield depends upon the price that is paid for the bond, and, as in the case of commodities, bond prices fluctuate according to the laws of supply and demand and to the quality or worth of the security in the opinion of the buying public. For instance, if a bond of a face value of $1,000 and paying six per cent interest can be bought in the market at 98, or, in other words, for $980, the income yield to the purchaser will not be six per cent but a little over 6.1 per cent. That is, a year's interest on the bond is $60. If it is bought for $980, the income will be $60÷980=6.1 per cent. Correspondingly, if the bond is bought above par, say 102, the income yield in that case will be $60÷1020=5.88 per cent.

In compiling the list below, the income yields given are perforce those determined by the market prices of the bonds at the time of writing, which is somewhat earlier than the date at which the magazine reaches its readers. But as the market price on stable securities such as these fluctuates very little the table is sufficiently accurate to enable the prospective purchaser to make his selection intelligently.

Bonds to Yield 4.50% to 5%

California Gas and Electric Company, San Francisco, Cal. General mortgage and collateral trust 5% bonds. Mature 1933. ($1,000.) Yield about 4.78

Cleveland Electric Illuminating Co., Cleveland, Ohio. First and refunding 5% bonds. Mature 1939. ($500.) Yield about 4.85

Commonwealth Edison Company, Chicago, Ill. First mortgage 5% bonds. Mature 1943. ($1,000.) Yield about 4.90

Edison Electric Illuminating Co., Brooklyn, N. Y. Consolidated 5% bonds. Mature 1995. ($1,000.) Yield about 4.50

Edison Electric Co., Los Angeles, Cal. First and refunding gold 5% bonds. Mature 1922. Yield about 4.75

Milwaukee Light, Heat & Traction Co., Milwaukee, Wis. First mortgage 5% gold bonds. Mature 1929. ($1,000.) Yield about 4.80

Milwaukee Electric Railway & Light Co., Milwaukee, Wis. Refunding and extension gold 4½% bonds. Mature 1931. ($1,000.) Yield about 4.95

Minneapolis General Electric Co., Minneapolis, Minn. First 5% bonds. Mature 1934. ($1,000.) Yield about 4.85

Muskogee Gas & Electric Co., Muskogee, Okla. First and refunding gold 5% bonds. Mature 1926. ($1,000.) Yield about 4.90

New York Gas & Electric Light, Heat & Power Co., New York City. First mortgage 5% bonds. Mature 1948. ($1,000.) Yield about 4.90

Pacific Elec. Ry. Co., Los Angeles, Cal. First gold 5% bonds. Mature 1942. ($1,000.) Yield about 4.75

Portland General Electric Co., Portland, Ore. First gold 5% bonds. Mature 1935. ($1,000.) Yield about 4.85

Rochester Railway & Light Co., Rochester, N. Y. Consolidated mortgage gold 5% bonds. Mature 1954. ($500.) Yield about 4.90

Scranton Electric Co., Scranton, Pa. First and refunding gold 5% bonds. Mature 1937. ($1,000.) Yield about 4.78

Washington Water Power Co., Spokane, Wash. First and refunding gold 5% bonds. Mature 1959. ($1,000.) Yield about 4.90

Union Electric Light & Power Co., St. Louis, Mo. First mortgage gold 5% bonds. Mature 1932. ($1,000.) Yield about 4.85

Bonds to Yield 5% to 5.50%

Asheville Power and Light Co., Asheville, N. C. Gold 5% bonds. Mature 1942. ($1,000.) Yield about 5.20

Buffalo General Electric Co., Buffalo, N. Y. First mortgage 5% bonds. Mature 1939. ($100.) Yield about 5.00

Buffalo & Niagara Falls Elec. Light & Power Co., Buffalo, N. Y. First 5% bonds. Mature 1942. ($500.) Yield about 5.00

Burlington Railway & Light Co., Burlington, Vt. First 5% bonds. Mature 1932. ($1,000.) Yield about 5.30

California Gas & Electric Corporation, San Francisco, Cal. Unifying and refunding gold 5% bonds. Mature 1937. ($1,000.) Yield about 5.25

Colorado Springs Light, Heat & Power Co., Colorado Springs, Colo. First and refunding gold 5% bonds. Mature 1919. ($100.) Yield about 5.10

Danville Street Railway & Light Co., Danville, Ill. Refunding mortgage gold 5 bonds%. Mature 1925. ($1,000.) Yield about 5.00

Denver City Tramway Co., Denver, Colo. First consolidated gold 5% bonds. Mature 1933. Yield about 5.00

Denver Gas & Electric Co., Denver, Colo. General (now first) mortgage 5% sinking fund gold bonds. Mature 1949. ($100.) Yield about 5.00

Eastern Pennsylvania Power Co., Easton, Pa. First and refunding gold 5% bonds. Mature 1939. ($500.) Yield about 5.25

Illinois Northern Utilities Co., Chicago, Ill. First and refunding 5% gold bonds. Mature 1957. ($1,000.) Yield about 5.30

Indiana Railways & Light Co., Indianapolis, Ind. First and refunding 5% bonds. Mature 1943. ($500.) Yield about 5.40

Kankakee Gas & Elec. Co., Kankakee, Ill. First and refunding mortgage 5% sinking fund gold bonds. Mature 1930. ($100.) Yield about 5.10

Los Angeles Gas & Electric Corp., Los Angeles, Cal. First and refunding gold 5% bonds. Mature 1939. ($1,000.) Yield about 5.07

Niagara Falls Power Co., Niagara Falls, N. Y. First Mortgage 5% bonds. Mature 1932. ($500.) Yield about 5.00

Northern California Power Co., San Francisco, Cal. Refunding and consolidated gold 5% bonds. Mature 1948. ($1,000.) Yield about 5.34

Oklahoma Railway Co., Oklahoma City, Okla. First and refunding gold 5% bonds. Mature 1941. ($1,000.) Yield about 5.37

Oklahoma Gas & Electric Co., Oklahoma City, Okla. First gold 5% bonds. Mature 1929. ($1,000.) Yield about 5.07

Pacific Light & Power Corp., Los Angeles, Cal. Collateral trust 6% bonds. Mature 1915. ($1,000.) Yield about 5.25

Pacific Light & Power Corp., Los Angeles, Cal. First and refunding mortgage 5% sinking fund gold bonds. Mature 1951. ($1,000.) Yield about 5.45

Pacific Light & Power Corp., Los Angeles, Cal. First gold 5% bonds. Mature 1942. ($1,000.) Yield about 5.00

Pacific Power & Light Co., New York City. First and refunding (now first) 5% bonds. Mature 1930. ($1,000.) Yield about 5.44

Port Huron Light & Power Co., Port Huron, Mich. First mortgage gold 5% bonds. Mature 1921. ($1,000.) Yield about 5.00

Portland Electric Co., Portland Me., First mortgage 5% bonds. Mature 1926. ($1,000.) Yield about 5.00

Portland Gas & Coke Co., Portland, Ore. First and refunding 5% bonds. Mature 1940. ($1,000.) Yield about 5.05

Portland Ry., Light & Power Co., Portland, Ore. First and refunding mortgage 5% sinking fund gold bonds. Mature 1942. ($100.) Yield about 5.25

Portsmouth (N. H.) Gas Company. Portsmouth, N. H. Refunding (now first) 5% gold bonds. Mature 1931. ($500.) Yield about 5.05

Public Service Company of Northern Illinois, Chicago, Ill. First and refunding gold 5% bonds. Mature 1956. ($1,000.) Yield about 5.13

Buying Stocks and Bonds on the Installment Plan

Most of the Stock Exchange brokers or investment bankers who have adopted the partial payment plan for the purchase of securities for customers using the installment plan, follow much the same system. When the intending buyer wishes to buy on the installment or part payment method he is required to pay as follows:

On a $1,000 high grade bond, $100.

On a $1,000 bond that is considered speculative, $200.

On stocks selling at $150 or upwards, one-third to one-half the full amount of the purchase price.

On stocks selling at $50 to $100, $20 per $100 share.

On stocks selling below $50 per share, $15 per share.

If a would-be purchaser of ten shares

of say Union Pacific wished to buy stock on the partial payment plan, an initial cash payment of $500 would be required. The balance on all stock bought this way would have to be paid for in regular monthly payments, usually $3 to $5 per month for each share of the stock so purchased.

The buyer of the ten Union Pacific shares would pay $30 to $50 per month and if he bought at $175 per share, for 10 shares, and paid $500 down, the balance due would be $1,250. This if paid off at the rate of $50 monthly would be all paid for in two years and one month. The dividends on the stock would meet the interest payments, and perhaps a little more so that the stock would be free and clear at the end of the period named.

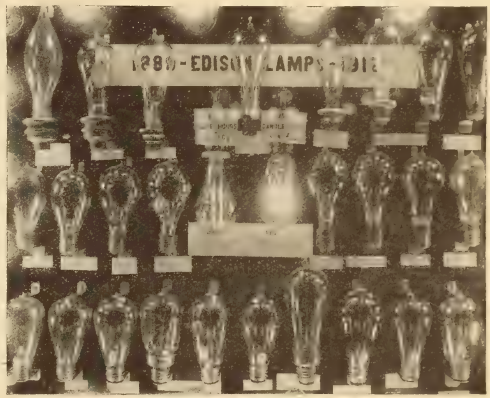
Altogether the buying of stocks and bonds by paying part of the purchase price down and the balance in one, two or three years or longer, is much the same as paying for a house in installments.

When considering the price of bonds it must not be forgotten that if the owner of bonds has reason to think that they, having advanced in price from the figure he originally gave for them, have reached as high as they are likely to go it will be the part of wisdom on his part to dispose of them at the profit and then reinvest his money in lower priced bonds, perhaps of later issue and on newer propositions, that are equally well secured and just as safe.

By following this plan he will be getting a better income or yield from them with, at the same time, the prospect of enhancement in the value of his property through an advance in their price.

Unique Lamp Exhibit

One of the interesting exhibits at the recent Electrical Exposition in New York, was that of the General Electric Company showing a collection of the various substances used by Edison in his search for a satisfactory filament. Another collection shown in the illustration, showed the development of the lamp itself, from those of 1880 to the high efficiency lamp in use at the present day. Among the lamps there was the old hand made bulb, with the bamboo filament, in which the vacuum was produced with a hand pump, and others of the early '80's with their wooden or plaster bases. Then were shown the various lamps that had been manufactured during the past 30 years; among them the gem, the tantalum, the pressed tungsten filament and the latest type of drawn wire Mazda. In 1881 only 30,000 lamps were manufactured while in 1910 the output was 80,000,000. The lamps of 30 years ago consumed 4.66 watts per candlepower as compared with the 1.17 watts consumed by the latest type of tungsten.



UNIQUE LAMP EXHIBIT

SCIENCE EXTRACTS FROM FOREIGN JOURNALS

London Railway Electrification.—The London and Northwestern railway as well as other railroad lines which are so extensively used in the suburbs of London are now to be equipped for running electric trains. This is a very extensive undertaking, and for the lines owned by one company alone the length of railroad to be fitted out for electric operating is about 80 miles. Passengers will now be able to travel between the city and suburbs under much better conditions than before, and it has long been desired to replace the steam trains by electric trains. Direct current on the 600 volt third rail system is to be used here, and the plans call for a power station of large size which will cover a seventeen acre site near the electric line and will be laid out so that it can be readily increased in the future. Steam turbines will be mounted in the station and they will supply high voltage current upon a power line which runs to a number of substations located along the railroad line so as to be able to supply this latter. Each of the electric cars will carry four motors and the trains will be made up of motor cars and trailers.—*The Electrician, London.*

Palace of Light at Ghent.—The Palace of Light is to be one of the original features of the Ghent Exposition of 1913. What is desired is to have the electrical exhibits laid out so that they will be displayed with a better effect than has usually been done at exhibitions. In fact the exhibits are rarely open at night, and during the day the lighting effects are not well brought out, seeing that daylight interferes with this. The new plans are quite original, and call for a vast space which is to be entirely closed, so that it is dark even during the day. But night will be turned into day by the brilliant arc lights, also incandescent and mercury vapor lamps, as well as the new Moore tubes and neon tubes which will be placed all around the hall. A very attractive effect is given by Geissler tubes of many hues which will be set in constant movement by electric motors.—*L'Electricien, Paris.*

Ordnance Manufacturing in Russia.—A large part of the ordnance the Russian army and navy is made at the large works of Motovilika, in the Perm district and within a recent date the works is engaged in putting in quite a number of electric motors so as to take the place of steam engines. To run the motors there is erected a good sized electric plant with 300 horsepower steam engines and dynamos and also a 400 horsepower Diesel oil engine set working on crude oil from the Russian wells. Besides, there will soon be installed a 1,200 horsepower Brown-Boveri steam turbine group of Swiss make. Throughout the shops are motors to the number of 2,450 at the present time, also eighteen traveling electric cranes of fifteen to 90 tons lift. The extensive shops are lighted by 6,450 incandescent lamps and 100 arcs. In the foundry is now running an electric furnace of considerable size which is proving very useful for this kind of work. The nickel plating shop is laid out on a large scale, and here are plated 25,000 projectiles a month.—*Revue Electrique, Paris.*

Low Aerials for Wireless.—M. E. Rothe finds that he can receive wireless messages from quite a long distance by the use of an aerial wire running along not far from the ground, so that this will be easier to mount than upon a pole. For instance at Nancy in the east of France he picked up signals from the Eiffel Tower and also from several German posts, with an 80 foot wire stretched at less than eight feet from the ground. In

later experiments at St. Dié, he used a copper wire run along on small stakes six inches high, the wire being attached without care as to having it insulated, and it even touched the grass at times. The shortest length he used was 50 feet and the wire was connected to buried water piping, using a self induction coil between. With a detector telephone and battery set, he could easily hear the Eiffel Tower signals. The garden in this case is entirely surrounded by an iron fence more than three feet high, but this did not appear to have a bad effect.—*Journal Academie des Sciences, Paris.*

Bearded Grain Draws Electricity from the Air.—Prof. Lemstrom, of the Helsingfors University, shows that bearded grain such as wheat acts in a hitherto unexpected way in order to draw in electricity from the air, and thus it serves as a veritable lightning rod. This produces a pronounced beneficent effect upon the wheat plant, seeing that the grain, at least and no doubt the other parts of the plant, are constantly in a a bath of electricity, and it is now well known that this acts to further the growth of plants to quite a considerable extent. Thus the yield of grain or vegetables is found to increase, according to experiments which have been made in various places. In Europe, farmers have hitherto preferred wheat which is not of the bearded variety for various reasons, although the latter is hardier in growth and produces more grain, as is well known. Now Prof. Lemstrom seems to prove that this superiority is due to the electric currents from the atmosphere. This is another point to be added to the knowledge we are now gaining on the subject of "electro-cultivation," as it is called.—*La Nature, Paris.*

Radium and Plant Growth.—It has already been observed that radium has the effect of increasing the growth of plants, and the new experiments made by J. Stoklasa throw new light upon this interesting field of study. Other workers used radium minerals or salts, but he makes use of the radium bearing mineral waters of Joachimsthal, taking the water directly from the springs each day and before it loses its effect. He shows that when grains are placed in this water, they grow at a surprisingly rapid rate; for instance, using barley grains, at eight days' growth the results were quite striking, for the roots were two inches long and the stalk three inches, while in ordinary water the roots showed but a quarter of an inch and the stalk only half an inch. Other plants gave equally good results. Grain also sprouts much quicker, as for instance it took only 24 to 36 hours for it to sprout when in the radium water and as long as 56 to 120 hours otherwise. Other equally surprising results come from the weight of the plants. After 40 days' growth, the weight for ten stalks of the same plant was over four times as much by the radium treatment.—*Journal Academie des Sciences, Paris.*

New Telegraph Recorder.—At the recent exhibition of new apparatus held in London by the Physical Society, Mr. S. G. Brown spoke of a new recorder for receiving telegraph messages over long lines and especially ocean cables. The current is very weak in such cases, and the signals are usually received in the siphon recorder, as the current is not strong enough to work another kind of device. Mr. Brown magnifies the current by the use of a new relay of his design. As usual, the current comes into a suspended coil which swings under the action of the current, but instead of using the siphon for ink signal record on the end of the arm attached to the coil, he uses a very ingenious method which consists of a pair of minature thermo-electric couples mounted on the arm. The two couples lie midway between two small spirit lamps, so that when the coil is not working, the ends of the thermo-couples are equally heated. When the coil moves

one of the couples comes nearer the flame, and these are now unequally heated so as to give rise to a current. What is remarkable is that this current is nearly 30 times as great as the telegraph current, so that it can be used to work other recording devices for the signals.—*The Electrician, London.*

Sending Colored Photograhps Over the Wire.—A scheme for sending photographs over the wire in their natural colors is devised by an Italian engineer, Q. Marino. As the apparatus is not made as yet, it is too soon to say whether it will work in practice, but the idea appears to be an attractive one, at any rate. Each point on the original color photograph, or even a natural object, is made to pass before an opening so that the light from this point is decomposed by a prism into the seven colors, in the case of white light, or into a less number. Each color falls on a separate selenium cell whose office is to send current over the line so that the cell having, for instance, red light upon it, will produce red at the other end. This is done by having the cells send a vibratory current which is tuned so as to work with tuned Poulsen arc lights at the receiving end. Without going into details, the selenium cell sends current in such way that the corresponding arc light operates and throws light through a red screen on to an autochrome photographic plate. Thus the red color spot at the sending end gives a red light spot at the receiving end and so on for all the different colors of the photograph.—*Genie Civil, Paris.*

Keeping Tab on an Electric Wagon

A convenient application of recording watt-hour meters is made in the electric wagon service of the Lowell, Mass., Electric Light Corporation, which is one of the most carefully handled services of its kind in New England. The power wagons shown are equipped with a Sangamo watt-hour meter calibrated between 60 and 115 volts, in addition to an ampere-hour meter, and by these instruments the company keeps a close record of the energy consumption of the machine in various classes of service, as well as the condition of the battery with respect to charge and discharge. The meters are mounted on the dashboard directly in front of the driver's steering wheel.

NEW BOOKS

LESSONS IN WIRELESS TELEGRAPHY. By Cole and Morgan. Newark, N. J.: Cole and Morgan. 1912. 62 pages with 59 illustrations. Price, 25 cents.

There are 30 lessons, arranged as far as possible in logical sequence, giving a systematic elementary course in the principles of wireless telegraph apparatus and the electrical laws upon which it depends.

WIRELESS TELEGRAPHY AND TELEPHONY SIMPLY EXPLAINED. By Alfred P. Morgan. New York: Norman W. Henley Publishing Company. 148 pages with 156 illustrations. Price, $1.00.

The book furnishes a comprehensive explanation in simple language of the theory and practice of wireless telegraphy and telephony and explains as far as possible the importance of its position today and the possibilities of tomorrow.

SAW FILING AND MANAGEMENT OF SAWS. By Robert Grimshaw. New York: Norman W. Henley Publishing Co. 1912. 129 pages with 106 illustrations. Price, $1.00.

This book is designed as a practical aid to those who use saws for any purpose. While, as its title implies, it treats principally of saw filing, it also goes into the questions of gumming, spring setting and swaging.

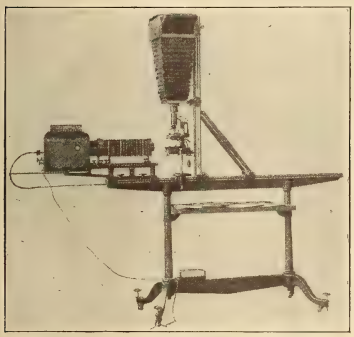
GASOLINE ENGINE TROUBLE CHART. By Victor W. Page. New York: The Norman W. Henley Publishing Company. Price, 25 cents.

A chart 25 by 38 inches showing a sectional view of a typical four cylinder, four cycle, gasoline engine and a tabulation of troubles, causes, symptoms and remedies to aid in clearing up any engine trouble.

Photographing Microscopic Objects

Tiny organisms or bits of mineral have been studied up to now by placing them upon a piece of glass called a "slide" and then slipping this glass into a holder under a microscope.

The electric photomicrographic apparatus, as it is called, changes all this



APPARATUS FOR PHOTOGRAPHING MICROSCOPIC OBJECTS

by taking a picture of the slide, using the microscope in doing so and giving us an enlarged picture of what we see if we look into the microscope itself.

The device consists of a camera, an ordinary microscope and either an arc lamp or a Nernst lamp enclosed in a lamp house and fitted with lenses for illuminating the slide during the picture taking. The equipment is fitted to a lathe like table with adjusting devices for accurate work. The camera may be placed in a vertical position and the microscope slide used to hold minerals and opaque objects while they are photographed.

By removing the camera and microscope from the stand the remaining apparatus may be used as a stereopticon.

A Revolutionary Improvement in Plate Printing

Plate printing, that is, printing from engraved steel plates, is likely to be revolutionized as the result of an experiment now in progress by the United States government. Until recently it was held by all experts in this, the highest branch of the printing art, that impressions of the first quality could be obtained from steel plates only by means of hand work and the use of a hand power press that has shown little modification in design from the original type of printing press devised by the Italian inventors centuries ago. It is this demand for manual labor unaided that Uncle Sam is now challenging by the unique experiment lately undertaken.

The old style plate press has been retained but the old wheel which the plate printer had to revolve in order to bring to bear the pressure needed for each impression has been supplanted. In its place there has been installed an electric motor which supplies energy for the printing operation and brings to bear each successive sheet of paper upon the inked steel surface with all that precision and evenness attained by the hand impression and which are essential for the transfer to the paper of all the exquisite details of lines and shading. The electric manipulation of the roll of the press not only minimizes labor but results in an appreciable saving of time.

The national government has worked out this problem in order to simplify the

task of printing our currency but it is expected that the discovery will be taken advantage of by commercial houses in all parts of the country that are engaged in the production of any of the classes of work to which the new scheme will be applicable. Uncle Sam is disposed to let

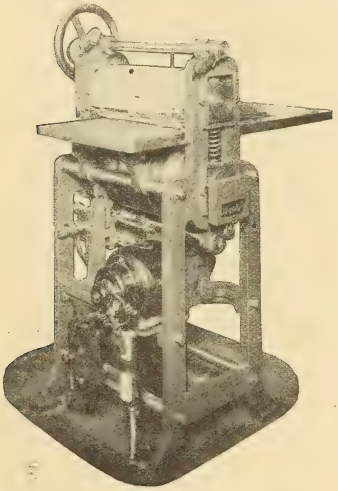


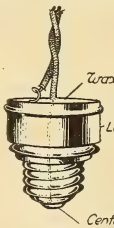
PLATE PRINTING PRESS MOTOR DRIVEN

all such interested persons into the secrets of the special type of motor which the experts designed for this work.

A specially wound armature on the motor, in conjunction with a controller of original design, results in the press starting slowly and gradually increasing speed until the roll reaches and engages the printing plate. Maximum speed is maintained during the passage of the roll across the engraved plate and then there is a gradual decrease in speed to an automatic stop. When it is explained that one second is the total elapsed time required for this operation from the time the current is turned on by means of footpedal control until the roller has mechanically come to rest it will be appreciated that careful calculation has been made and when it is stated that this operation will be repeated more than 100 times an hour during eight or sixteen hours per day it can be realized that severe exactions are placed upon the motor.

Tests already made show that motor drive will increase the speed of a plate press at least ten per cent. The average skilled operative of a hand press prints about 110 sheets per hour whereas a speed of 121 sheets per hour has been recorded by the electrically operated press under favorable conditions and a record of 100 sheets in 35 minutes has been made in a spurt. The aid of the magic current does not reduce this highly specialized form of printing to the level of the mechanical because now, as formerly, the inking of the plate, which is done by hand, determines in great measure the quality of the product but, as has been explained, it increases production and by relieving the operative of the most arduous manual labor allows him to devote greater care to the exacting duty of inking and rubbing the surface of the printing plate by hand.

Emergency Extension Plug

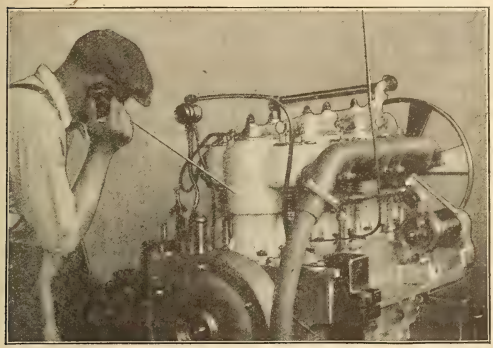


EXTENSION PLUG

In a case where a plug could not be obtained in time for use on an extension light I made a plug from a tungsten lamp base in the following manner: The two wires of an ordinary drop cord were soldered one to the center contact and the other to the screw shell of a tungsten lamp, the whole interior being then filled with sealing wax. A socket connected to the other end completed the extension which was used until a regular plug could be delivered.—H. G. Wilson.

Stethoscope to Detect "Valve Slap"

There is no marked similarity between the physician's office of a life insurance company and the engine testing room of a motor car factory, yet they have points in common. Among the tests given in each place is that of the stethoscope.



LISTENING FOR VALVE SLAP

The physician uses it to detect irregularities of the heart—the mechanic to discover any unevenness of operation inthe motor.

While serving the same purpose as the stethoscope, the instrument used in the high grade motor car factories is slightly different in appearance. It consists of a steel rod made of three separate pieces combined with a regulation telephone receiver. By placing the end of the rod against the side of a motor it is possible to locate the source of the smallest disturbance. The lightest of "valve slaps" or knocks in the engine are thus noted, allowing the correction of any fault before mounting the motor on a chassis. The road testers carry similar instruments as an extra precaution against the possibility of a car being turned over to the sales department with a faulty motor.

The accompanying photograph shows a workman testing a six cylinder motor for interior trouble.

Automatic Electric Generator for Country Homes

There has lately been put on the market in France an electro-generative outfit which seems to have overcome some of the difficulties of small lighting equipments by means which are both simple and ingenious. When the motor is supplied with its combustible, lubricating oil and cooling water, the apparatus furnishes automatically the current necessary for lighting or other purposes on the turning of a switch.

The arrangement consists of a small gasoline or benzine engine attached by a belt to a dynamo, a tank for the combustible and another for the cooling water, a battery of a small number of elements acting as an accumulator and a starting rheostat. The whole is mounted on a pair of I beams, and is so light that it can be moved around very easily.

The apparatus being connected with the wiring system of the house, a switch is closed which discharges the current of the accumulators upon the circuit thus opened; this current is sufficient to supply, for a time, three or four lamps without the help of the engine. But if another switch is closed and the current becomes insufficient for doing the work in hand the dynamo, acting as a motor, is connected. This moves with increasing speed, carrying with it the engine, until the latter begins to work of itself. The dynamo is then driven by the engine and produces current to feed the lamps and to re-charge the accumulators.

If at any moment the charge diminishes to a point where it does not exceed the capacity of the accumulators, the dynamo stops and the accumulators are dis-

charged upon the line. Each time that the accumulator charge is lowered below its normal voltage, even if there are no lamps lighted, the apparatus is automatically set in motion to re-charge the accumulators. All these maneuvers are effected by the movements of an electromagnetic relay on the switchboard.

The Bond Tester

The current which leaves the trolley wire through the trolley pole passes through the car motor and then must return to the power house along the rails of the tracks if no return wire is provided. For this reason each rail is connected to the next by a good heavy wire which is called a "rail bond." This bond

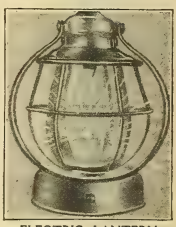
BOND TESTER.

or connecting wire between the rails must be at all times in good condition and to determine this men called "bond testers" travel along the tracks and make tests where the rail ends meet.

Without going into detail the tester shown in the picture equipped with a Roller outfit works about as follows: The inverted T shaped wooden bar is placed on the rails under test. It has three saw blade contacts which are connected by flexible conductors to the portable galvanometer swung from his neck. Since current from cars is always flowing along the tracks some of it will flow by way of the contacts through the galvanometer and deflect the needle, but just how much will depend upon the condition of the bond wire.

Electric Lantern

An electric lantern designed by a locomotive engineer and following the lines of a Pullman conductor's lantern is being placed on the market by a Chicago firm.



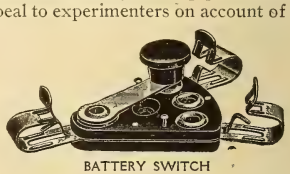
ELECTRIC LANTERN

The body of the Jenks lantern is made of brass heavily nickel plated and weighs 2¼ pounds. In the base is a three cell dry battery which supplies current to an incandescent lamp. When the lantern is lifted by the bail the lamp lights up. By dropping the bail on one side the light is turned out, while dropping the bail to the other side keeps the light burning.

The lantern does away with the use of oil and the cleaning of smoky chimneys and it cannot be blown out by wind.

Battery Switch

This switch is designed for service upon battery and magneto circuits. The Fahnestock spring binding posts make it appeal to experimenters on account of the



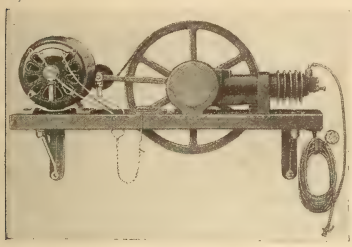
BATTERY SWITCH

ease and quickness with which wires are connected and disconnected.

Automobile Tire Pump

Considering the amount of hard work this pump can save, its low cost of operation is surprising, since at ordinary rates for electricity it will operate for less than one cent an hour. The cost of filling a tire is therefore insignificant.

The operating parts of the Vaile-Kimes pump, which is operated by a



TIRE PUMP

small Westinghouse motor, are enclosed in an oil tight, dust proof casing, so that practically no attention is required.

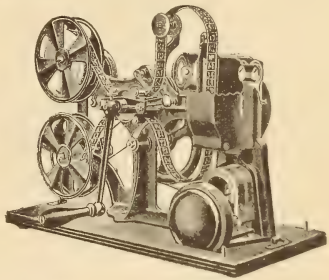
A pressure gauge registering up to 150 pounds is provided as part of the outfit. The automobile owner is, therefore, able to maintain his tires at the proper pressure, which adds greatly to their life. It is impossible for oil to get into the tire through this pump, so that rotting from this cause is prevented.

Moving Pictures by Incandescent Lamp

Much enjoyment as well as instruction can be had during winter evenings by the use of the new moving picture machines of small size, and these are coming into service in Paris and other cities for use in the family circle. It may seem strange that the metallic filament electric lamp is responsible for a great deal of this progress in making a simple and inexpensive machine. As soon as it was found that the lamps would flash up and die out much quicker than the ordinary carbon filament lamp, inventors set to work to make a machine in which the lamp would flash up at one-tenth of a second, that is, making a separate flash just as each picture passed before it. This brilliant flash sends a strong light through the picture film just at the moment it is needed, then the light goes out while the film is passing on.

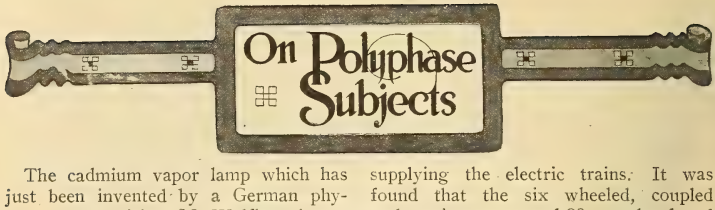
Before this a revolving shutter was needed to stop off the light while the pictures were being changed.

The new Pathé machine is here illustrated. It uses non-combustible film of smaller size than usual, and at the factory there is a special camera apparatus for reproducing the standard films in this small size. The film will be seen passing in front of the small electric lamp, the light being concentrated by reflector and lens. A magneto supplies the current and an extra brilliant light is given at each impulse by the use of a much higher current than the lamp is made for. This uses up the lamp very quickly, but it costs but little, and one lamp lasts for about ten hours. Even with this small appara-



MOVING PICTURE MACHINE OPERATED BY INCANDESCENT LAMP

tus and using an incandescent lamp which would give but two candlepower usually, the picture appears in an excellent light on a screen three feet square, which is very good for use in an ordinary room. For schools the new machine will prove excellent.



A New Electric Vapor Lamp

The cadmium vapor lamp which has just been invented by a German physician, M. Wolfke, gives a white light. Every one knows the mercury vapor lamp: it has the advantage of being very economical from the point of view of current consumption, but the green coloration of its light limits its usefulness very considerably. M. Wolfke, after having tried a great number of metals and alloys, seems to have solved the problem by an amalgam of cadmium with a small quantity of mercury. Cadmium has the following properties which make it very suitable for this purpose; its temperature of vaporization in a vacuum is low (450° C.); it does not attack glass; its spectrum contains red radiations. Pure cadmium used in a lamp gives a red light; with the addition of from three to ten per cent of mercury it produces a very satisfactory white light. Here seems to be an interesting question for inventors and electricians. If a mercury vapor lamp gives a green light, and a cadmium lamp a red light, and a combination of the two in certain proportions gives a white light, then how shall a blue or yellow light be produced, if such should be desired?

Steam, Electricity and Coal

For a time, during the transition from steam to electricity on the Southport Branch of the Lancashire and Yorkshire Railway, it was necessary to run steam trains between the electrical trains, at the same speed. This afforded an opportunity to compare the coal consumption of the locomotives with that of the power house supplying the electric trains. It was found that the six wheeled, coupled tank engines consumed 80 pounds of coal per train mile for express trains, and 100 pounds for accommodation trains. The consumption of coal at the power station for the electrical trains was 49 pounds per train mile.

Trolley Wire Frees Captive Balloon

A rather unusual accident occurred at Venice, Calif., recently, when the captive balloon with three passengers was suddenly freed and blown out over the ocean.

The balloon had just risen to the end of its cable when a freakish wind caught the big bag and forced it towards the ground. The steel cable came in contact with a trolley wire and the electric current burned it in two almost instantly. The balloon floated upward and for an hour and a half drifted about in the air sometimes near the land and sometimes far out over the water. About four miles from the San Pedro breakwater the pilot finally noticed some boats beneath him and, descending, they were rescued.

The International Candle

Something over three years ago a new unit of electric illumination, called the "international candle," was adopted by France, England and the United States. The American standard candle was thereby reduced one and six-tenths per cent in order to make it uniform with the English candle and the Bougie Decimale of France. The value of the Hefner, the German unit, is nine-tenths that of the international candle.

The French visitor to Gelligaer showed some alarm at the prospect of passing a savage looking dog that stood in the way, barking furiously.

"It's all right," said his host. "Don't you know the proverb, 'Barking dogs don't bite?'"

"Ah, yes," said the Frenchman, "I know ze proverbe, you know ze proverbe, but ze question is, does ze dog know ze proverbe?"

* * *

A traveler in Indiana noticed that a farmer was having trouble with his horse. It would start, go slowly for a short distance and then stop again. Finally the traveler approached and asked, solicitously: "Is your horse sick?"

"Not as I knows of."

"Is he balky?"

"No. But he is so danged 'fraid I'll say whoa and he won't hear me, that he stops every once in a while to listen."

* * *

"God bless mama and papa, and God bless Harrigan," said little George, aged four years, as he knelt beside his mother for his evening prayer.

"Why, George," said his mother, "who is Harrigan?"

"That's me," he replied.

* * *

"You are rather a small boy to be earning five dollars a week."

"I suppose I am," he replied. "I know I'm small for my age, but to tell the truth, since I've worked here I've been so busy I haven't had time to grow."

He got the "raise."

* * *

Some years ago a prominent man went into the business of raising hogs. Friends congratulated him on his success, as his breeds were certainly fine. "Hogs!" replied he contemptuously. "Why, these people never knew what a big hog was till I came here!" And he wondered why they laughed.

* * *

Teacher—"Johnny, what is a skeleton?"

Johnny—"Please, ma'am, it's a man with his insides out, and his outsides off."

Subbubs had taken Chumleigh home to dine. Everything went well until they were seated at the dinner table, when Willie Subbubs remarked, "Why, pa, this is roast beef!"

"Well," said his father, "what of it?"

"Why, I heard you tell ma at breakfast that you were going to bring a mutton head home for dinner this evening."

* * *

"Why do you use paint?" asked a violinist of his daughter.

"For the same reason that you use resin, papa."

"How is that?"

"Why, to help me draw my beau."

* * *

Not long ago Bishop Greer recounted some amusing replies to examination questions given by Chinese students. The first of them is evidence how rapidly the sporting instinct is spreading. In answer to the question, "What are the five great races of mankind?" one student replied: "The hundred yards, the hurdles, the quarter mile, the mile and the three miles."

* * *

"It is the duty of everyone to make at least one person happy during the week," said a Sunday school teacher.

"Now, have you done so Johnny?"

"Yes," said Johnny, promptly.

"That's right. What did you do?"

"I went to see my aunt, and she's always happy when I go home!"

* * *

"So you advertised for your lost purse, pretending that the person who found it was recognized?"

"Yes."

"How did the bluff work?"

"Didn't work at all. Next day this ad appeared in the same paper: 'The recognized gentleman who picked up the purse on Boylston street requests the loser to call at his house.'"

* * *

"That lawyer of mine has a nerve."

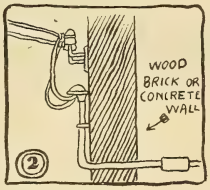
"Why so?"

"Listen to this item in his bill: 'For waking up in the night and thinking over your case, $5.'"

THE ELECTRICAL HOUSE THAT JACK BUILT

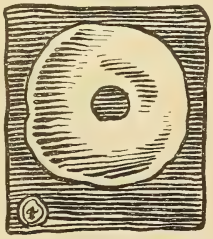
THIS IS THE HOUSE THAT JACK BUILT

THESE ARE THE WIRES THAT WIRED THE HOUSE THAT JACK BUILT

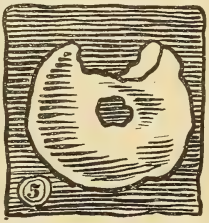


THIS IS THE ELECTRIC RANGE THAT J.'S WIFE BOUGHT AND ATTACHED TO THE ENDS OF TWO OF THE WIRES THAT WIRED THE H. THAT J. BUILT

THIS IS THE SINKER ALL FORLORN THAT J.S WIFE COOKED UPON THE RANGE ATTACHED TO THE ENDS OF TWO OF THE WIRES THAT WIRED THE H. THAT J. BUILT

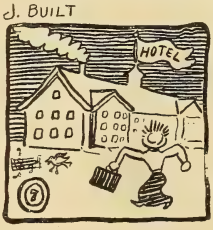


THIS IS THE BITE ALL TATTERED & TORN J. TOOK FROM THE SINKER ALL FORLORN THAT WAS COOKED ON THE RANGE ATTACHED TO THE WIRES THAT WIRED THE H. THAT J. BUILT

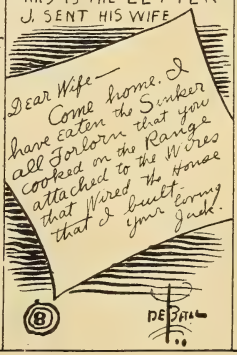


THIS IS THE WINDOW OUT OF WHICH J. HEAVED THE SINKER ALL FORLORN THAT WAS COOKED ON THE RANGE ATTACHED TO THE WIRES THAT WIRED THE H. THAT J. BUILT

THIS IS THE HOUSE IN RENO WHERE J.S WIFE WENT WHEN HE CAST AWAY THE BEAUTIFUL SINKER ALL FORLORN THAT WAS COOKED ON THE RANGE ATTACHED TO THE WIRES THAT WIRED THE H. THAT J. BUILT



THIS IS THE LETTER J. SENT HIS WIFE



SO SHE CAME BACK AND THEY LIVED HAPPILY AND PROSPERED — AND SHE COOKS NO MORE SINKERS ALL FORLORN UPON THE RANGE ETC..

POPULAR ELECTRICITY MAGAZINE

In Plain English

HENRY WALTER YOUNG, Editor

Vol. V | April, 1913 | No. 12

CONTENTS

	Page
A Telegraph Line in the Wilderness	1263
Electrolytic Iron	1267
The Faraday Centenary	1268
Automobile Door Lighting Switch	1269
San Francisco's Electric Service	1269
Electric Light in Unexpected Places	1269
Award of American Museum of Safety Medals	1270
Horizontal telephone Switchboard	1271
Counting Laundered Currency	1272
Experiments in Magnetic Action	1273
X-Rays and Coal	1273
Time Recording Lock	1274
Liquid Air and Magnetism	1274
Electricity Moves Western Bumper Crops	1275
Heat from Electric Lamps	1275
Electro-Chemistry and Precious Gems	1275
Grooming the Horse	1276
Safety From Lightning in Cities	1277
Giant Electric Incubator	1278
Electro-Plating Aluminum	1278
Startling Trailer for Electric Car	1279
Automatic Tunnel Lights	1279
Electrical Oddities	1279
Effects of Magnetism on Watches	1279
The Blue Room Mystery	1280
The Weather and the Output Curve	1284
Box Cars Loaded by Motor	1285
The Bothersome Ohms	1285
Ignition of Firedamp by Breaking Incandescent Lamps	1285
Humane Destruction of Superfluous Animals	1286
Copper Refining Plant in Montana	1287
Bright Future for Electric Power in Ireland	1288
Heated Coat for Astronomers	1290
Electrician Heroes	1290
An Ideal Electric Plant on a Farm	1291
Boston Articulated Trolley Car	1292
The World's Greatest Battleship and Her Electrical Equipment	1292
College Class Leaves Memorial	1294
Electric Charge on Rain	1294
Where Carbon Rules	1294
Modern Interurban Stations	1295
Electric Bells Rung by the Sun	1295
The Sick Friend Story	1296
An Electric Mail Carrier	1299
Ozone in Tunnels of the Central London Railway	1300
For Transporting Lamps	1302
Crane Service as a Way Station	1302
Experiments with Selenium	1303
Telephone Hook Holder	1303
Lineman's Aerial Car	1303
Termites Destroy a Cable	1303
Electric Smelter Plant in California	1304
Removing Top Soil by Electric Power	1305
Rutile	1305
A Portable Photo-Telegraph	1306
Incandescent Lamp as a Telephone	1307
Fleeing from Electricity	1307
Tungsten Filament Plays Trick	1308
Electric Cross for Historic Church	1308
An Elevated Railway for Trolley Cars	1309
Logging by Electricity	1310
Utilizing the Power of the Columbia	1310
The Simplicity of Quality	1311
Vaporized Quartz	1318
Harnessing the Tide	1318
White Lines to Protect Life	1318
Giant Electric Crane	1318
Magnet Bill	1319
Safety Switches on Old 17 Mile Grade	1319
Instructor's Variable Resistance Unit	1320
German Miner's Electric Lamp	1320
Flickerless Moving Pictures	1320
Electric Truck as a Moving Power Plant	1322
Telephone Dispatching on the Canadian Pacific	1322
Combined Window Sign and Reflector	1322
Lightning Discharges from Kites	1323
Ventriloquism and the Loud Speaking Telephone	1323
Magnetic attraction and the Compass	1323
Glove with Audible and Visible Signal	1324
Odd Gent Collectors on Italian Cars	1324
Tension on the Surface of Charged Conductors	1324
Dr. Bergonie's Apparatus	1325
Semi-Indirect Units	1326
Electricity Used in Dyeing Cloth	1326
Street Car Held to be "Vehicle"	1326
The Crookedest, Costliest Roulette Wheel	1327
Electric Power Drainage of a Coal Field	1331
Warships Injured by Electricity	1331
Chicago's Freak Car Line	1332
Electrical Men of the Times. Vladimir Karapetoff	1334
Telephones Served with Your Meals	1336
The Largest Water Turbine	1337
New Rail Joint	1337

Electrical Interests of Women

An April Shower	1338
Chafing Dish Artists	1341
Electric Cooking in a Palace of India	1342
The Modern Concrete Home	1343
Batiken Color Designs	1344
The Domestic Revolution	1344
Cost of Operating Electric Irons	1345
Modern Dusting	1345

Junior Section

Electricity for the Homes of the Swiss	1346
Aeronautic Advertising	1349
Electric Music Teacher	1350
Laboratory Air Pump from Bicycle Pump	1350
New York Horse Car in Snow Storm	1351
Table for Residence Telephones	1351

Popular Electricity Wireless Club

Experimental 200 Meter Wave Sets	1352
A New Detector	1353
Wireless Outfit as Novel Motion Picture Attraction	1355
Two Hundred Watt Closed Core Transformer	1356
Judgment for the Marconi Company	1357
Canadian Boats Compelled to Carry Wireless	1357
New York Clubs Form Relay	1357
Wireless Club Directory	1358
Knob and Tube and Cleat Wiring	1359

For Practical Electrical Workers

Insulating Nail	1361
New Torch for Linemen	1362
Bed Warmer	1362
Combined Fish Wire and Drill	1362
Steps Turn Off Cellar Light	1363
Electrical Rat Trap	1363
Elementary Electricity for Practical Workers	1364
The Usherless Theater	1368
Simple Telephone System	1370
Converting Gas Fixtures to Electric	1370
Control for Steam Heating System	1371
The Tree System	1371
Coil Winder	1372
Boxing and Connecting Dry Cells	1372
Motor and Brake Attachment for Sewing Machines	1373
Colored Lacquer for Lamp Globes	1373
The Mysterious Skeleton	1374
The Talking Pumpkin	1374

Miscellaneous

Electrical Securities	1375
List of Selected Bonds Showing Income Yield	1377
The Greatest Meetings of Electrical Companies	1378
Science Extracts from Foreign Journals	1379
New Books	1381

Electric Current at Work

Flywheel Motor Starter	1382
The Octophone	1383
The Ozonator	1384
Motor Driven Hack Saw	1385
Telephone Mug Holder	1385
Electric Puff Iron	1386
Power Driven Hedge Trimmer	1386
The Resonator	1386
Early Electric Motors	1387
A Move in the Right Direction	1388
Electricity and Growing Plants	1388
Short Circuits	1389

RENEWALS When your subscription expires, you will find a renewal blank enclosed here. You should fill out and return with remittance at once to avoid missing a number. Positively no copies will be mailed on any subscription after same expires unless renewed, and we cannot agree to begin subscriptions with back numbers. The date on wrapper of your magazine shows issue with which your subscription ends. The extension on this date to period covered by renewal is sufficient receipt. If any other is desired it should be requested at time of renewal.

CHANGE OF ADDRESS Notify us promptly of any change in your address, giving both the old and new location. Since our mailing list for each issue closes the 5th of the preceding month (i. e., list for May closes April 5th), changes received after the 5th must necessarily take effect with issue for second month following. Postmaster as well as Publisher should always be notified of changes in order to forward mail sent to old address.

ISSUED MONTHLY BY POPULAR ELECTRICITY PUBLISHING CO., Commercial Bldg., Chicago, Ill.
YEARLY SUBSCRIPTION, $1.50; CANADIAN, $1.85; FOREIGN, $2.25; SINGLE COPY, 15 CENTS
No additional copies will be sent after expiration of subscription except upon renewal.
Entered as Second Class Matter April 14, 1908, at the Post Office at Chicago. Under Act of March 3, 1879.

Copyright, 1913, by Popular Electricity Publishing Co.

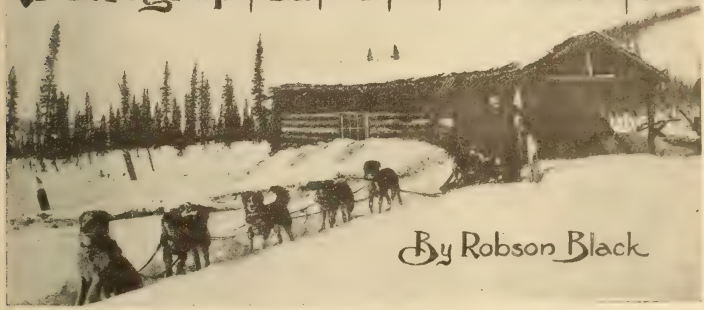
TO THE DWELLER IN THE FAR NORTH THE PITIFUL STRAND OF WIRE, SAGGING DOWN LIKE A CLOTHESLINE AND KEPT IN REPAIR UNDER CONDITIONS OF GREATEST HARDSHIP, SIZES UP AS A STRAND OF GOLD

Scene: "A Telegraph Line in the Wilderness."

Popular Electricity Magazine In Plain English

VOL. V. APRIL, 1913 No. 12

A Telegraph Line in the Wilderness



By Robson Black

From Ashcroft on the old Caribou road to British Columbia, winding northward for 2500 miles, runs the Yukon telegraph, the most remarkable and romantic telegraph line in all America. Its origin was like no other; its operation never had and perhaps never will have an analogy; its service to mankind has certainly never been surpassed.

The visitor trailing his goods into the lone north land seeking a gold claim in the bed of a rivulet, or staking his future on a free farm and a muscular back, may jeer at the low straggling poles with the wire sagging down like the domestic clothesline back home. But when he tastes for a month or two the supreme isolation of that infinite silent wilderness, that pitiful strand of wire will size up as a strand of gold.

The Yukon telegraph was born in the feverish days of 1890, when it seemed that half America was turned northward to wrestle with the little god of Chance. In those days it had two kinds of stories to deliver, one of the "lucky strike" transforming a penniless tramp into a millionaire, the other of some mute tragedy of the wayside, wherein a discouraged adventurer wrapped himself and his hopes in the snows by the trailside and left the remainder to Providence.

To-day when the reckless glories of that "wickedest camp on earth" have given way to a standard of respecta-

THE SUPREME ISOLATION OF THE INFINITE AND SILENT WILDERNESS

bility and a firm obedience to law and order, the little Yukon telegraph tirelessly fulfills its duties. Now, however, it flashes a new code of success, the code of the pioneer farmer whose cottages are fast trailing up the northern valleys, searching out the last choice spots in Canada where the speculator has not stuck his signboard. Last year the Dominion Government lost $80,000 on the line, but as an old northern traveler said: "It was the best $80,000 ever invested."

The valleys filling up with pioneers—the Bulkley, the Kispiox and the Naas—are

THE ROUGHLY BUILT OPERATORS CABINS ARE LOCATED AT INTERVALS OF 50 MILES

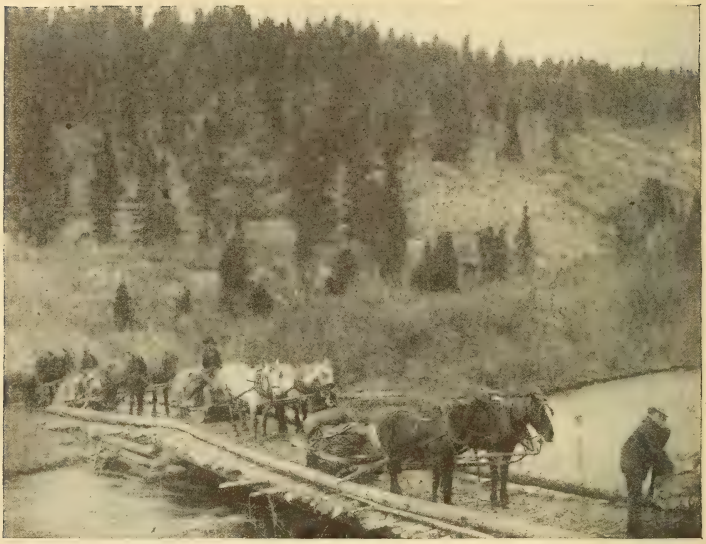
tered communities from Prince Rupert to the Arctic Circle, the Government wire forms the link and the only link with the great news events of the out-side world. On the occasion of the prize fight at Reno on July 4th, two years ago, when every Anglo-Saxon between the Forty-ninth Parallel and the North Pole was anxiously awaiting the result, the fateful message, "Johnson wins in the fourteenth." was received in Prince Rupert within three minutes of the catastrophe. The same flash was received in Dawson a minute later, the wire having been kept clear for the all-im-

A TRAIL IN THE LONE NORTHLAND

those through which the telegraph passes. Up in that land the railway is short, but the telegraph is long—and in the settlement of the earth one seems to balance the absence of the other. For the thousands of white men in the scat-

portant climax of that interesting event.

The route of the line is almost parallel to that weird and abandoned survey of the Western Union half a century ago, when that company after the breaking of the Atlantic cable in 1859 decided to



METHOD OF TRANSPORTING SUPPLIES NEAR THE LOWER EXTREMITY OF THE GREAT TELEGRAPH LINE, IN BRITISH COLUMBIA

lay a land line through Alaska and Siberia to Europe. Over three million dollars had been spent on the line when the company recalled the plans, having in the meantime picked up its Atlantic cable again. Some of its engineers and linemen were then so far inland that it was nine months from the time the order was sent until it could be delivered to them. For many miles, portions of the Western Union wire are now being worked as an auxiliary by the Dominion government.

At intervals of from seventeen to 50 miles the operators live out their lonely and dangerous lives in their roughly built cabins. That each operator should be an expert lineman is a necessity of the task, and those with the long sections located on flat lands are given a horse to assist in the inspections. In the mountain districts, much shorter sections are in an operator's care and in the depth of winter he is called upon not infrequently to tramp on snowshoes across treacherous areas to repair his wires.

In some districts winter departs for only two months in the twelve, so that day and night, month by month, the deadening loneliness of perpetual snow threatens to drive a man into melancholia. It is a heavy test of human endurance, not so much in the times of activity as when the monotony of existence turns a week into an eternity. Twice a year the supplies of food are "packed" in, and then the operator and his visitors exhaust the possibilities of conversation. For the rest of the time, it is only a break in the line that gives a man a chance to meet his comrades. When that significant accident occurs, he loads his tools on his back and marches forth in search of the interruption.

Two of the worst foes of the mountain operator are the forest fire and the avalanche. Again and again their depredations sweep away poles and wires, demanding heroic service of the linemen to restore normal conditions. Sometimes the official reports to headquarters sum up a situation in this fashion: "We had frequent breaks in the line owing to fires on the Yukon River and to storms between Atlin and Dawson, but repairs were quickly effected." An eye witness of one of these storms (scarcely mentioned by the superintendent) described it as an avalanche of ice and snow that had swept great rocks and giant trees like matchwood before it down the mountain side. The slide measured 1,200 feet across and 80 feet deep. It could have buried out of sight a good sized town. Yet when it was necessary to re-establish the wires and poles ripped to shreds in its thunderous course, the linemen took it as "a little incident" scarce worth writing about to headquarters.

Here is a characteristic report as it was handed in by one lineman. Let the reader fill in for himself the ample spaces between the phrases:

"May 5, 1912, 7.30 a. m. started on line north from Maple Bay; removed two trees, replaced wire on four poles two miles north of here; put up quarter mile of wire at camp at Swamp Point; replaced two blocks, two glasses at White Point; replaced wire on five poles; used five blocks, three glasses; removed three trees; fell off bluff here into deep water; lost tool bag with spurs, etc.; had hard time keeping afloat until Dalgleish picked me up, account wearing hip rubbers and raincoat; removed one tree; replaced wire on two poles north of Tad's Cove. Home 2. a. m. 6th."

Most linemen, no matter how devoted, would have postponed work for the day, after a narrow escape from drowning. Here was a worker who again tackled his job, removed one tree, and replaced wire on two poles. Then he went home.

Every year the federal government extends the branch lines, keeping ever ahead of the steady stream of settlers. The main line connects at Ashcroft with the Canadian Pacific Railway system. At its northern extremity it joins the United States signal service on the Alaskan boundry. Its longest branch is 200 miles, from Hazelton, an old Hudson Bay trading post, to Prince Rupert.

Electrolytic Iron

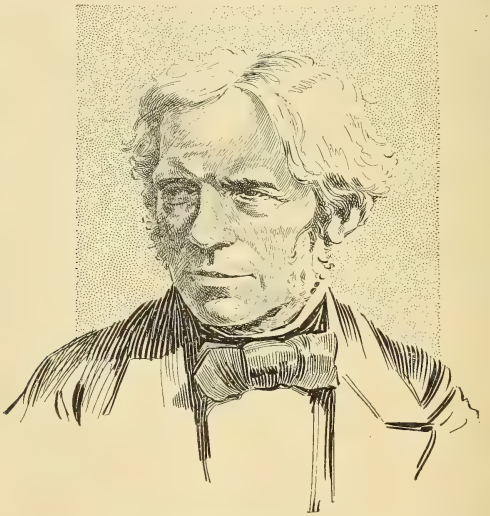
This process for obtaining pure iron is due to M. F. Fischer, and has been put in operation at the Langbein Pfannhauser workshops at Leipsic. The method seems to have reached the stage of industrial application and now electrolytic iron is used for a number of purposes. The metal is obtained by the electrolysis of a solution of a salt of iron; the metal deposited by the electric current by the latest method is perfectly pure and contains no trace of hydrogen. In the attempts made until now by other investigators it has been the presence of hydrogen in the product which, rendering it porous and of no consistence, made it worthless.

The hardness of the iron obtained by M. Fischer is not greater than that of aluminum. It has great magnetic permeability, it magnetizes and demagnetizes much more quickly than ordinary iron and does not retain any residual magnetism. This quality is valuable in the manufacture of electric motors. Usually armature plates are made of steel, but it is found that the substitution of the electrolytic iron for the steel increases the efficiency of the motor by a considerable amount. Two motors of exactly the same dimensions and construction have been tested; in one the plates were of steel and in the other of electrolytic iron. It was found that the power of the second was nearly three times that of the first, which proves very conclusively the value of this new iron in the construction of electrical machinery.

THE FARADAY CENTENARY

In March of this year, the learned world of England in general, and the Royal Institution of London in particular, will celebrate the first centenary of Faraday's connection with that institution.

Born in 1791, Michael Faraday, the son of a poor blacksmith living near London, was at the age of thirteen apprenticed to a bookbinder. One day a customer took him to hear some lectures by Sir Humphry Davy. Faraday was so impressed by what he heard that he wrote out the notes he had taken and sent them to the lecturer. The consequence of this was that, a vacancy occurring soon afterwards, Sir Humphry Davy used his influence to have the young man appointed his assistant in chemistry. On the first of March, 1813, he began his duties; twelve years afterwards he became director of the chemical laboratory of the Royal Institution.



MICHAEL FARADAY

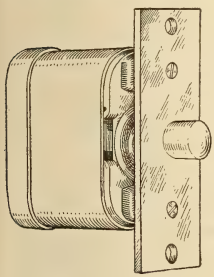
In 1824 Faraday began to suspect that an electric current could be produced in a wire by a current in another wire or by a magnet. But it was not until 1831 that he published his discovery of the principle of induction, upon which the action of all our dynamo-electric machines of to-day depends. About the same time he discoverel a method for the production of a glass of high refractive power, which has greatly increased the scope and value of optical instruments. About the same time he enunciated the laws of electrolytic action and made the first dynamo. In 1845 he sent a report to the Royal Institution on diamagnetism, that property of bodies by virtue of which certain metals, such as gold, silver, lead, mercury, bismuth, etc., will when freely suspended take a position at right angles to the lines of magnetic force, and

consequently at right angles to the direction of the magnetic needle.

Faraday died in London in 1867, after being honored by many of the learned societies of Europe. Shortly before his death he was given a pension of $1,500 a year from the British government, and a residence in Hampton Court. On being offered a baronetcy, however, he refused it, saying that as he could not learn anything from it, he did not want it.

Automobile Door Lighting Switch

Push and pull battery switches are used extensively for controlling the lighting of the head, side and tail lamps, and for lamps used inside limousines and electric vehicles. Another feature has now been added by several automobile manufacturers, which provides for automatically lighting up the running board when the door is opened, either in getting in or out of the vehicle.



AUTOMOBILE DOOR LIGHT SWITCH

Small "slow break" switches have been tried but with poor results because arcing results when the door is only partly ajar. The C-H "quick make-and-break" door switch for automobile use, shown full size in the accompanying illustration, does, however, meet the demand for a switch for this service. The mechanism is so constructed that no half-way position of the contacts is possible, the switch is either positively closed or open. The opening of the door causes the operating bar to spring out, automatically closing the circuit and lighting the foot lamp, while closing the door automatically opens the lamp circuit. A strike plate is placed on the door against which the extending bar strikes.

San Francisco's Electric Service

An electric light and power company drawing much of its current from the watersheds of the Sierra Nevada Mountains in California states a few interesting figures relative to the electric service it renders the city of San Francisco. In the matter of illumination, the Queen City of the Pacific is supplied with 9,500,000 candlepower. She has 600 miles of lighted streets. On all thoroughfares the electric lamps are elevated on large ornamental poles, while on Fillmore Street, the booming White Way after the fire and earthquake of 1906, ornamental arches extend for fourteen blocks. At night, the New San Francisco glows brighter than ever. Her seven hills may be truthfully said to outshine the seven hills of Rome, and an indication of what her coming Panama-Pacific Exposition will be lies in her contemplated plan to use some five billion candlepower in that great undertaking.

Electric Light in Unexpected Places

The catacombs of St. Calixtus, near Rome, were not long ago illuminated with thousands of electric lamps, filling the gloomy vaults and passages with a bright light, whose effect, as it fell upon the rows of bones and skeletons, is described as being startling and almost uncanny. The use of electric lights in the catacombs is perhaps the most unique example of modern practical science brought face to face with antiquity. This, however, would be exceeded by the introduction of the electric light in the galleries of the great pyramids of Egypt. It is reported that the Egyptian government has for some time been considering the feasibility of this.

At least two places within the Arctic Circle have received the electric light. Hammerfest and Tromsö are now lighted by electricity, so that they have an artificial daylight during the long winter darkness.

AWARD OF AMERICAN MUSEUM OF SAFETY MEDALS

In one way or another, electricity, either for the precautions taken to safeguard against its dangers; its application as a means of removing the causes of industrial disease; the development of apparatus to offset its powers, or its actual adoption as an agent for safety, held a prominent place in connection with the award of medals by the American Museum of Safety in New York, on January 23.

It was the development of the pulmotor, a machine for resuscitating persons suffering asphyxiation or from electric shock, that won the *Scientific American* medal for the Draeger Oxygen Apparatus Company. For the precautions it has taken in safeguarding its workers from the danger of electric shock as well as its welfare work, the New York Edison Company received the medal donated by the Travelers Insurance Company. The National Cash Register Company has installed an elaborate system of safety devices for protecting its workers from the dangers of industrial disease and part of this safety system is a motor driven exhaust which carries all the metal filings from the air in which the men work. For this precaution the Louis Livingston Seaman medal was awarded. To Thomas Alva Edison was presented the Rathenau medal in recognition of the part his invention, the portable storage battery, has played in the elimination of danger to underground workers.

Officials of the various companies were present to receive the medals from the hand of Professor Frederick R. Hutton, vice president of the museum. Edison, however, was not present, Mrs. Edison receiving the medal for her husband and explaining that for three months he had been confined to his laboratory, and had declared he would not leave until he had perfected the kinetophone.

Edison is the first recipient of the Rathenau medal, which is placed at the disposal of the museum by the Allgemeine Electricitäts Gesellschaft of Berlin; to be awarded annually for the best device or process in the electrical industry for safeguarding industrial life and health. The medal was originally presented to Dr. Emil Rathenau of Berlin, by the Kaiser and now arrangements have been made for the striking of one

SAFETY ELECTRIC MINE LAMP WHICH WON THE RATHENAU MEDAL FOR THOMAS A. EDISON

medal each year, to be awarded by the museum. In seeking one worthy of the medal the museum has the whole world to select from.

Next year, according to an announcement by President Arthur Williams, the museum will have another honor to bestow, for Mrs. Mary W. Harriman has donated the E. H. Harriman Memorial Gold Medal to be awarded the American steam railroad making the best record in accident prevention and industrial hygiene, affecting both the public and its own personnel.

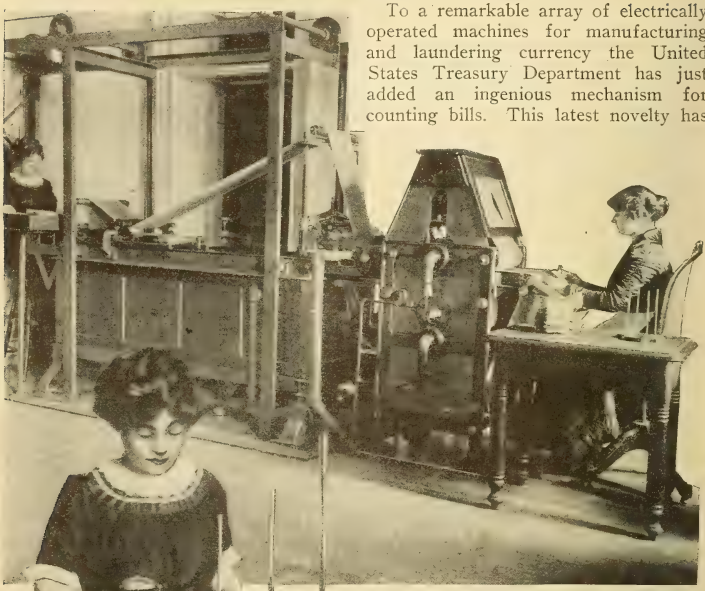
Horizontal Telephone Switchboard

In striking contrast to the vertical panels of the telephone switchboards of the modern American exchange is the horizontal arrangement here shown. This is a picture of a large exchange in Berlin, Germany. The operators sit at both sides of the switchboard and in front of each at the edge of the board are the plugs and keys used in operating. While the horizontal board affords a ready surface for the accumulation of dust it is evident that this is not allowed to gather, the two uniformed employees being shown at work with vacuum cleaners fitted with proper tools for keeping the board dustless.

SOME OF THE TELEPHONE SWITCHBOARDS IN GERMANY ARE PLACED HORIZONTALLY AND ARE CLEANED WITH VACUUM CLEANERS

COUNTING LAUNDERED CURRENCY

To a remarkable array of electrically operated machines for manufacturing and laundering currency the United States Treasury Department has just added an ingenious mechanism for counting bills. This latest novelty has been developed under Uncle Sam's auspices, the inventor being Mr. John P. Buckley, a mechanical expert of the treasury.



LAUNDERING PAPER CURRENCY

MACHINE THAT COUNTS AND WRAPS PAPER CURRENCY

Thus far only one machine has been built and that is in operation in the departmental building at Washington, but duplicates have been ordered and batteries of the electrical bill counters will ere long be installed not only at the treasury but in the subtreasuries throughout the country.

With the machine operated by electric current and a young woman merely feeding in the bills this mechanical money enumerator will readily count 35,000 bills per day, or two or three times the number that could be counted in the same interval by the most expert hand

counter. Ultimately the inventor hopes to perfect an automatic feeding attachment that will run the daily capacity up to 100,000 bills.

However, mere speed in counting is by no means the only advantage of the new invention. Even more important perhaps is the fact that it eliminates all necessity for a certain mental strain that is imposed upon the human money counter when counting assorted bills of various denominations. With this new apparatus in operation all bank notes of a given denomination are fed into one box, boxes being provided for the various denominations of, say, $1 to $20 and thus the liability of mistakes and confusion is reduced to a minimum. Furthermore, this counting machine has demonstrated an ability to handle new or laundered currency with equal facility, although as a matter of fact it was devised primarily for handling the cleansed bills as they come from the lately perfected washing and ironing machine.

The fundamental mechanism of the money counter consists of a number of metal wheels and rolls in contact and under the influence of a half ampere electric current. The feeding of a bill between the brass wheels and rolls breaks the circuit and simultaneously an electro-magnet which has been actuated by the current ceases to act. The effect of this is to give play to springs that by their action raise two doors in the form of flaps that bar the way to the compartment provided for the bills of the particular denomination involved. It is the raising of these little doors by the pull of the springs that operates the mechanical counter which keeps tab on the number of bills passing through.

As the feeding of the bill has had the effect of breaking the electric circuit so, to reverse the situation, the ejection of the banknote by the rolls re-establishes the electric contact, whereupon the magnets draw down the flaps or tiny doors above mentioned and the bill finds its proper destination in the receptacle provided for it.

As each hundredth bill is counted the doors or flaps are mechanically tripped and remain up to bar the passage of more bills until the operator has put in place the marker that is inserted to separate the accumulating bills into packages of one hundred.

An ingenious feature of the machine is that it will not register a count unless a greenback or yellowback actually passes through the rolls. The inventor's latest addition to this seemingly perfect example of the machine that "almost thinks" is a double note detector which automatically prevents the operator from feeding in two bills or notes at the same time. Such a mistake will cause a warning bell to ring and the notes to remain on the flaps instead of dropping into the boxes.

Experiments in Magnetic Action

A very pretty line of experiments is carried out by floating bicycle balls in mercury and bringing a strong magnet near them. They arrange themselves symmetrically under the influence of the stresses, and assume very curious positions, varying with their number and the intensity of magnetization. It is a variation of an old experiment known as Mayer's needles, in which needles are floated in water by bits of cork and are subjected at the same time to the influence of a magnet.

X-Rays and Coal

A French experimenter suggests that the X-ray furnishes a ready means to detect stony impurities in coal. Carbon is very transparent to the Roentgen rays, while silica is opaque to them. Consequently the silicates, which form slag when coal is burned, can be seen like a skeleton when the shadow of the coal is projected upon an X-ray fluorescent screen.

Time Recording Lock

The electric time recording lock gives to the proprietor or manager of any store, shop or establishment, a printed record of the exact times any door to which it is attached is unlocked or locked and who unlocks or locks it. The device consists of a lock and a recorder. With the lock are six keys numbered from one to six.

The recorder is a small automatic printing machine connected with the lock by electric wire. The recorder may be kept in the desk of the proprietor or the manager or placed anywhere in the building. Whenever the lock is turned by anyone entering or leaving the shop, the recorder prints automatically the number of the key, whether "in" or "out" and the time. For example, if the employe carrying key number five opens the store in the morning, the record will show K5 IN Oct. 8 7:00 AM 1912.

A watchman's key may be used if desired that will make a record each time it is inserted but will not turn the lock, recording W Oct. 8 2:50 AM 1912. The record is printed on paper ribbon three inches wide automatically carried forward as needed.

The proprietor may be away from his business a week or a month or a year and returning, unlock the recorder and find the accurate printed record for the entire time of his absence. The recorder is controlled by a master clock. The power is supplied by batteries. The recorder may be attached not only to outside doors but to stock rooms, store rooms or offices. It may also be used to record the opening and closing of desks, show cases, deposit boxes, cabinets or like places on which it is desired that a record be kept.

SPECIAL KEYS ARE USED IN CONNECTION WITH THE RECORDER SYSTEM

THE RECORDER IS A SMALL AUTOMATIC PRINTING MACHINE KEPT ON THE DESK OF THE PROPRIETOR.

Liquid Air and Magnetism

When steel is dipped into liquid air its magnetism is curiously affected. Non-magnetic nickel acquires magnetic properties after being immersed for five minutes in liquid air. Manganese steel is similarly affected. The density of carbon steel is perceptibly decreased after the immersion.

Electricity Moves Western Bumper Crops

The crops of 1912 were the largest in the history of the country. In many localities electric roads competed with steam in moving the harvest. The illustration shows an electrically drawn train in the state of Washington being loaded with grain, most of which was consigned to Seattle for the export trade. Electric lines are increasing rapidly in the extreme west and are playing an important part in the development of that section of the country.

Electro-Chemistry and Precious Gems

Will prospecting and seeking for the natural gems soon follow those other trades and callings which have been doomed to extinction? Will the successors of these prospectors be found in the electro-chemical laboratories? The idea is fascinating and it is by no means far-fetched. Not only have the purest and finest gems of the earth been duplicated and produced by the disintegrating heat of the electric furnace and blowpipe, but new creations have been evolved and semi-precious products have been treated

ELECTRIC LOCOMOTIVES MOVING WASHINGTON GRAIN

Heat from Electric Lamps

In consequence of certain experiments made in England, shopkeepers are warned of the danger of allowing inflammable goods to get into contact with the bulbs of incandescent electric lamps. The widespread notion that such lamps are practically free from heat is erroneous. A sixteen candlepower electric lamp immersed in half a pint of water will cause the water to boil within an hour. If buried in cotton wool it will set the latter aflame.

to enhance their value. With the investigations that are being undergone in the field of higher temperatures and synthetic productions, many new industrial processes will be eventually established.

In the making of precious gems, the products must not be classed as imitations as these gems of science are identical in all particulars with the purest gems produced by Nature; identical in properties and appearance. The compositions of all gems have been long known to the expert, the problem of fabrication being simply that of melting or fusing thor-

oughly. The base of the ruby, emerald, sapphire, etc., is alumina, whose melting point was above the possible limit of technical application until the high temperatures of the blowpipe and electric furnace were applied industrially.

Taking the ruby as an example, a solution of common alum to which a trace of chrome alum is added as the necessary coloring, a gelatinous precipitate is formed by adding ammonia. This precipitate of the hydrates of alumnia and chromium is evaporated to dryness and calcined into oxide, ground to a fine powder and the heat applied so that every particle of powder passes through the flame of 2000° C. It fuses and builds itself into pear shaped "bruts" which are in a condition of high strain, similar to the familiar "Prince Rupert's Drops." Once, however, this strain is neutralized by breakage, they are ready for the cutting and polishing, and in beauty of color, hardness, durability, composition and refraction are identical with the purest gems from the mines of Burma.

So absolute is this identity that brokers no longer will accept the ruby and the German jewelry trade has petitioned for legislation compelling the synthetic gems to be so distinguished and designated. This applies also to the other gems of color and truly the doom of the mined gem has been sounded.

The problem of making the diamond is purely one of high temperature and sufficient pressure and when large quanities of material can be handled with the same facility as small amounts, the diamonds produced will be proportionately larger. At present those produced are of microscopical size but nevertheless diamonds.

Sir Wm. Crookes estimates that as the boiling point of carbon is below the melting point, it is necessary to employ a higher temperature than its boiling point of 3,500° C. and a high pressure as well, or a temperature of 4,200° C. By the explosion of cordite in a closed cylinder, Noble has attained 5,200° C. with a pressure of 50 tons and it is probable that the commercial productions will be along these lines. The product and methods are so well understood that it only requires perfection of mechanism to produce them as successfully as the ruby, sapphire and emerald.

The attempts to liquefy carbon at the ordinary atmospheric pressure even in the high heat of the electric furnace has hitherto been unsuccessful. La Rosa has found that with the singing electric arc that higher temperatures could be obtained at atmospheric pressure than were possible with the furnace, and the use of pure sugar carbon as an electrode for the intermittent singing arc showed crust formations formed from the fusion of small particles of carbon, indicating that the liquefaction of the carbon was probable.

An analysis of the arc spectrum showed that the temperature was higher than either the ordinary arc or the electric furnace. From the powder of the sugar carbon small crystals were obtained with a specific gravity of 3.2 and whose hardness in scratching a ruby showed them to be either carborundum or diamonds and as the absence of any silica in the materials used eliminated carborundum the results proved that the diamond could be formed of fused carbon with a normal atmospheric pressure. This leads investigators into a new channel which is sure to develop new theories and processes.

A colorless, transparent crystal of carborundum has been produced as an index of refraction exceeding that of the diamond. The mixture used is pure carbon 30 per cent., silicia 57 per cent., sawdust nine per cent. and common salt four per cent. A special manipulation is carried on in the electric furnace to prevent the formation of an impure product. A small amount of a metallic oxide, such as chrominum oxide in the mass, produces a colorless crystal and a new gem.

Prof. Berthelot has found that it was possible to decolorize certain gems by means of high temperature and subsequently restore their color by means of

radium. With the amethyst he found the color was due to a minute quantity of manganese. Heating the stone reduces the manganese and the color disappears. The action of radium consists in re-oxidizing the manganese with the consequent restoration of the color. A week's exposure to the radium was necessary to complete the restoration. A like change also occurs in plain glass which assumes a deep violet hue when exposed a long time to the action of radium and which may be decolorized by heat. This also opens a new line of investigation which should prove of value.

The influence of radium on the diamond is also marked. After long exposure it takes on a bluish tinge which is not affected by heating with vitric acid, calcium chloride, or heating to redness, and after an influence of twelve months' duration the diamond attains a lasting radio-activity and retains its bluish color. Sir Wm. Crookes is conducting extensive experiments in this direction.

Many mtthods are in use which have as their object the improvement of gems or precious stones and by various methods their colors may be intensified, or coloring matter introduced and flaws removed. The flaws are removed from rubies by packing in reduced iron and igniting. The color of carnelian and pink topaz is also due to high temperatures. Since ancient times precious stones have been dyed or colored artificially and many so treated are in use to-day. In the semi-precious stones the making of onyx from chalcedony is most interesting. Chalcedony is formed of layers of colorless silica of differing degrees of porosity. They are soaked in honey and water at a carefully regulated temperature and then placed in sulphuric acid which chars the sugar in the pores, the carbon thus deposited produces a jet black stone which after a treatment with oil produces a beautiful brilliancy. A red color is produced by soaking in a solution of ferrous sulphate and igniting and blue is produced by copper sulphate and ammonia.

These processes could be improved by an increased use of the electric element to replace the chemical heat of the acids. It is said that a Florentine anatomist discovered a process whereby flesh or any organic matter could be transformed into agate by a siliceous solution but his secret died with him. There is in the San Spirito hospital a table slab polished and showing a human heart, lungs and accompanying organs. The chemical processes will in time be improved by the use of electricity and as the properties and utilities of the combined science become better understood, many new industries will be created from the development of those experiments so far limited to the laboratory of investigation.

Grooming the Horse

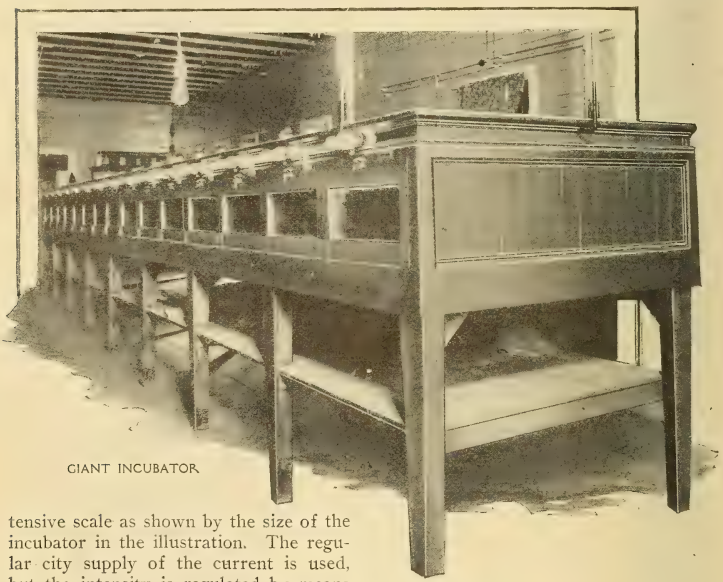
A reader of this magazine after having experimented with several different machines for grooming a horse has settled upon the vacuum cleaner as the most practicable. A currycomb and brush will only take the larger particles of dirt and dust and the smaller particles cannot be brushed out. The operation of the machine for this purpose is simple, all the work required being to hold the nozzle of the cleaner about an inch from the horse's hide. If the nozzle of the cleaner is held too close it will cause an uncomfortable pulling of the hair. When the horse is covered with a thick heavy mud, a currycomb must be used to break it up a little.

Safety from Lightning in Cities

The fear of lightning is almost universal, but the number of deaths caused by it is small. Dwellers in cities are even safer than those in the country, since statistics have shown that on the average, four-fifths of the deaths from lightning occur in rural districts. The innumerable electric wires, the many grounded water pipes and the metal roofs of cities are undoubtedly the chief elements of their safety in this respect.

Giant Electric Incubator

Electricity, it has been discovered, is the best possible medium to use to heat an incubator for hatching eggs. In New Orleans this is being done on a very extensive scale as shown by the size of the incubator in the illustration. The regular city supply of the current is used, but the intensity is regulated by means of a thermostat. Thus any temperature desired can be obtained and held, something practically impossible with the oil lamps formerly used for the purpose. Very little care is required. About all it amounts to is an occasional reading of the thermostat and taking out the eggs once in every 24 hours, so that they may be aired.



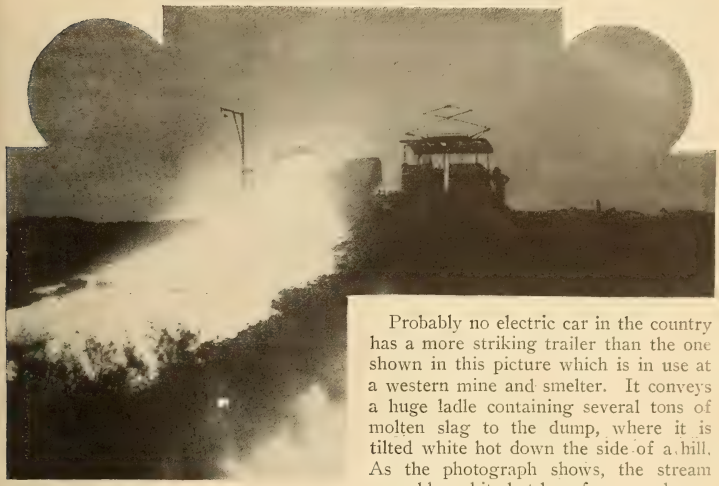
GIANT INCUBATOR

The course of the blood vessels in dead animals or birds is now examined by the X-rays. In order to make the arteries, etc., give a photograph, or "radiograph," they are first injected with mercury.

Electro-Plating Aluminum

Aluminum has, since its production been so enormously cheapened, come into general use for a multiplicity of purposes. For a long time one great drawback to its use was the rapidity with which its surface became dull and leaden in hue owing to rapid oxidation. This characteristic prevented aluminum from being easily electro-plated with gold or silver as is the case with copper; but this difficulty has been removed by the discovery of a method by which aluminum can be given a coating of any desired metal. The film of oxide which covers the surface of the aluminum is removed by adding to the plating bath a small quantity of soluble fluoride and the metal then receives a superficial coating of zinc or copper upon which silver or gold can be subsequently deposited.

STARTLING TRAILER FOR ELECTRIC CAR



Probably no electric car in the country has a more striking trailer than the one shown in this picture which is in use at a western mine and smelter. It conveys a huge ladle containing several tons of molten slag to the dump, where it is tilted white hot down the side of a hill. As the photograph shows, the stream resembles white hot lava from a volcano.

Automatic Tunnel Lights

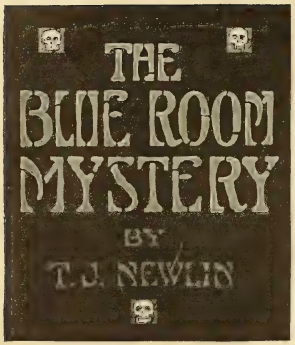
In the Batignolles tunnel, near Paris, incandescent electric lamps, arranged in rows along the tunnel walls, are automatically illuminated and extinguished by passing trains, the rims of the car wheels operating the electric switches. The lamps, being each of ten candle-power, and placed at the height of the car windows, serve to illuminate the interior of the passing coaches, thus superseding the use of lights in the train.

Electrical Oddities

A Belgian writer describes an electrically driven machine for felling trees. By means of a reciprocating steel wire making 1,500 oscillations per minute a tree one foot in diameter can be felled in two minutes. An apparatus for the electrocution of insects in soil or on trees by a 0.5 micro-ampere current at 500,000 volts, is also described.

Effect of Magnetism on Watches

Some experiments have been made by members of the Royal Astronomical Society, England, to ascertain the effect of magnetism on watches and chronometers. It was found that a field of one unit would change a chronometer's daily rate by one second, the change being temporary and vanishing on removal of the field. The change altered in sign when the watch was turned round in the magnetic field. The so-called "nonmagnetic" watches were very satisfactory, the change being negligible for fields up to 20 units. When placed directly between the poles of an electro-magnet, the change in the daily rate was less than two minutes. Iron box shields were found to be very efficient protection against magnetism. The experiments taken as a whole show that the changes in the rate of watches are due to the magnetization of the steel of the balance.



That the eye can be deceived, and readily so, is very easily substantiated. One has only to refer to my former article on the Black Art illusion, in the November issue. The line of demarcation between black art and the blue room illusion, however, is almost absolute. The great blue room illusion is directly and decidedly opposite to the black art, inasmuch as the black art is produced by interposing a series of incandescent glare lights before the eye beyond which you are physically unable to penetrate, whereas in the wonderful blue room illusion, this imponderable trick of legerdemain is performed upon an open stage; right before your very eyes and with the electric light turned on.

To prove how easily the eye can be deceived, as is done by these optical electrical illusions, I will ask you to observe the peculiarity of the cube puzzle, as shown in Fig. 1. When you first gaze at this miniature optical illusion you will notice what will appear to be seven cubes. After gazing at them for a few seconds you will notice there are but six. Watching them intently, they again go back to seven in number. You may see six to start with but the number will be changed after a few seconds.

Now what becomes of the elusive cube? This is a simple deduction if you understand the explanation of "scotoma" and the interpretation of white and black. The phenomenon which causes the cube to appear and disappear is what is known as "retinal fatigue." That is to say, the constant stimulation of the retina by the light has caused an insensitiveness for that part of the retina previously occupied by the white color until it has grown tired of the sensation of white and seeks its opposite or complementary color, while the part occupied by the black or negative color has received no stimulation; and the eye, fatigued as it is, always seeks and accepts a rest by exchanging the black or the white field for its respective opposite.

After thus illustrating the manner in which our eyes may fool us in spite of ourselves, and utilizing the phenomena, I will show you the important use of the incandescent lamp by magicians. And I will reveal and unfold to you the guarded secret of one of the greatest and most mysterious illusions of the present day.

The mystery of the blue room is a trick of legerdemain which was produced by the world-famous magician, the late Mr. Kellar. With one simple little incandescent lamp and a mirror he baffled and mystified the whole world. You can do it also. Mr. Kellar laid great stress upon the arrangement of the insignificant yet significant little lamp. It must be placed just so, burning to proper brightness.

In this blue room illusion I am expounding I will show you how, by the use of electricity and the science of optics, you will be able to place a bare plant upon the stage and make it grow leaves, then follow this up by making the same plant grow real oranges before your very eyes, all of which you can pluck and can pass out to the audience for them to eat. Or, in turn, should you wish you can place a bony skeleton there instead of the plant, and make the clothes appear upon it; then cause the whole thing to turn into a real, live human being, man or woman, who will step down and walk out among your now completely mystified audience.

To begin with, your stage should have a front opening about fifteen to 20 feet wide and about ten to fifteen feet high. The depth of the stage should be slightly greater than the breadth, say from five to ten feet. This should be done in order to allow you to work behind your mirror when making the magic changes. The entire stage must be lined or draped with a warm blue colored draping composed of gingham, muslin or other soft material. Arrange as shown in the plan, Fig. 2. At the front of the

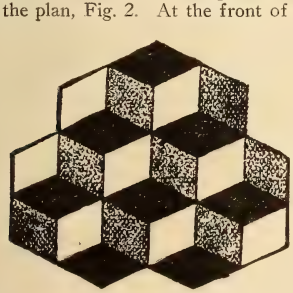


FIG. 1. LOOK INTENTLY AT THE MIDDLE CUBE FOR A TIME. SEVEN CUBES WILL APPEAR: THEN SIX: THEN SEVEN AGAIN, AND SO ON AS LONG AS YOU CONTINUE TO GAZE

stage opening two small wings (A), extending outward toward the center of the stage should be built. Extending from the center of the stage opening to the proscenium arch (P), hung from the poles or wires above your stage opening, are blue plush drapery curtains with numerous convolutions in them in order to gain the æsthetic effect. When the stage is in operation, as when producing the illusion, the draperies were drawn back from the center of the stage opening to the edge of the mask wings (A), as shown in Fig. 1.

Behind one of these mask wings is hidden from view the chair (C'). At the back (or "up stage" as the stage electricians call it) is a large mirror (M) to which are attached the rubber tired wheels (W). The mirror is so arranged that it can be pushed and pulled back and forth on a grooved wooden track, the soft, rubber tired wheels acting as a cushion against possible noise or vibration which may lead to possible detection should a sudden jar occur. The mirror must move very slowly and steadily and should be in careful hands, as one careless jolt or a too quick shove may be seen by the audience which is ever critical and on the alert.

The top of the mirror is made to run in a corresponding wooden grove as an auxiliary guide to hold it steady and to prevent its toppling over; and should be set in a corresponding position to the wooden track, only directly above. These tracks are set at an angle of about 45 degrees to a plane running parallel to a line of vision of your audience. In other words to the left side of the stage the large mirror should be placed which extends clear to the top of the stage opening to prevent detection and set at such an angle that at the very moment this mirror (M) passes the edge (X) of the chair (C), which is set at the back part of the stage and facing the audience, it will immediately reflect the outer edge (X') of the chair (C') which is hidden from the view of the audience by the mask wing (A).

In Fig. 3, a full view of the stage as viewed by the audience is shown in perspective. You will observe the large

mirror about to pass in front of the chair which is set up stage, and about to reflect the edge of the chair behind the wing into the eyes of the audience.

By the arrangement of the peculiar blue lighting and the hazy reflection of the blue draperies, the audience fails to

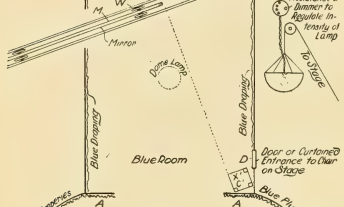


FIG. 2. PLAN OF THE STAGE AS ARRANGED FOR THE BLUE ROOM MYSTERY

see the ponderous mirror which silently and gradually passes in front of the eyes in this visible, yet invisible manner.

At the center of the stage, in a dome-like canopy, is the all important feature of this illusion—the electric lamp. This lamp is hung at the extreme top of the dome and is a sixteen candlepower having a frosted bulb. The lamp proper is enclosed in another cover which is also frosted and is properly speaking an actual dome light casing as shown in the detail, Fig. 2, and must be set just so in order to give the desired lighting effect to the blue room. If it is too dull it will spoil the illusion by allowing no reflection of the subdued rays from the mirror and if too bright it will expose the whole trick. In order to secure the right mixture of the soft blue lighting the lamp should be made to raise and lower and should be placed on a small dimmer.

Personally you should stand out front, where your audience must needs be and have your assistant raise and lower the lamp until you secure the proper mixture of lighting.

Do not fail to notice if you can observe the mirror, as you have him run it back and forth across the stage. Particularly notice if you can observe any escaping rays from the incandescent light in the dome stealing through the apertures or interstices of your curtain or otherwise masked stage.

Have the assistant push the mirror across the stage until it is about to cross the point (X) on chair (C) Fig. 2. Then observe by changing the chair (C') if they exactly coincide. That is, at the very moment that the point (X) on chair (C) is crossed by the mirror see that the latter reflects the point (X') of chair (C'). If it does not, see that it does actually take in the whole chair as it slowly cuts from view the one set up stage while gradually passing before it, and takes on and reflects the one down stage.

In trying out this illusion, have your house lights entirely out or dimmed down low on the resistance and have the lighting set just as you would if your audience were present and the show was on. Then again see to it that that little incandescent lamp in your stage dome is just right. Furthermore the electrician should always be prepared and see to every detail before starting the illusion.

Mr. Kellar, the late magician, was known to change his lamps again and again and have the stage electrician almost distracted, so great a stress did he lay upon the detail of his lighting. The perfect finesse with which the great magician would go about this illusion was wonderful. He never failed to let the electrician distinctly understand that the whole scheme depended upon the proper lighting and the mixture of the blue color. Never was a more nervous or more strenuous man seen about the stage as regards the lighting.

After ascertaining that everything is in readiness the magician now prepares to

go into the illusion. After a laconic speech stating he will make a plant grow from a sprout, and leaves grow on the stem, after which he will make oranges break out before your very eyes or a woman appear from a mass of human bones, he proceeds to go into this gigantic trick of legerdemain. At the cue or signal the blue plush curtains are drawn back and after uttering a short incantation and making a few magic passes or gestures, the magician has you fix your attention upon the sprout on the stage, far back, resting on a chair amid the soft blue lighting.

As you steadily watch the sprout it gradually grows larger and larger until it suddenly breaks forth into leaves. After taking on the leaves so mysteriously and while you are held transfixed by the seemingly impossible, lo and behold, from behind this phantom mass of leaves break forth a number of oranges.

Of course they are not real, and you whisper to your neighbor in the adjacent seat that it is only a trick. And that is what the magician said, only you have forgotten for the time that you are being imposed upon. You fail to realize as you sit spellbound that the magician—having divined this very question—is asking you: "Beg pardon, did you say they were not real?" And before you have "come out of it" he is far away up stage breaking off one of the oranges. As you continue to watch him, still in a trance, you can just realize he is appearing to you again from a distance. Coming toward the footlights he singles you out and with a knowing wink and a cynical smile he deftly casts you one of the oranges for inspection.

It was all very simple, as you can readily see. While you were gazing intently at the setting on the chair (C) in Fig. 2 far back up stage, you did not realize that the soft blue color vibrating in your eye held your vision in check so that you did not perceive that the ponderous mirror was being slowly made to travel past the chair.

Two flower pots are used up to this juncture. The pot at (C) contains a small sprout, whereas the pot at (C') has a stem and leaves. So, as the mirror is silently pushed across the stage on the rubber tired wheels, it gradually cuts from view of the audience the up stage pot as it gradually takes on the reflection of the stem and leaves of the down stage plant.

The mirror is now in front of the chair (C) and the latter is hidden from the audience, which is gazing intently at the leaves and stem that have grown from the sprout. The assistant now gets busy. He takes from behind the mirror the pot with the sprout in it and replaces it with a third pot containing a full grown plant,

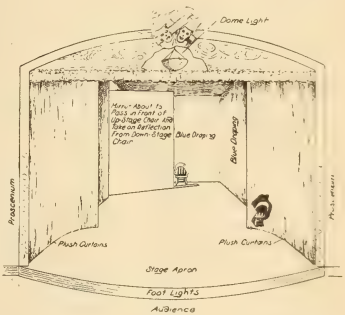


FIG. 3. FULL VIEW OF THE STAGE

arranged the same in size, shape, etc., as the one at (C') now being reflected into the eyes of the audience. In this third pot the leaves and stems have fastened to them real full grown oranges. After placing the plant so as to coincide as heretofore, the mirror is slowly withdrawn from the stage as previously described. As it gradually passes from in front of the pot on chair (C), the oranges are slowly brought into view, and, as the reflections of the leaves from the pot at (C') are gradually cut off by the action of withdrawing the mirror, the full-grow plant containing the real oranges is

in turn exposed to the critical view of your spellbound audience. Stepping quickly up stage now, the magician can readily pluck some of the oranges to pass out.

If this trick of legerdemain has mystified you, the one following will more than do so. The magician is now seen placing a weird and bony skeleton of a human being in the "up stage" chair. Then he comes down and steps forward to the apron of the stage and explains, in his suave manner, that he will endeavor to make this inanimate mass of human bones turn into a real, live, beautiful woman; and this he proceeds to do.

In causing a real, live man or woman to appear, the same *modus operandi* is followed.

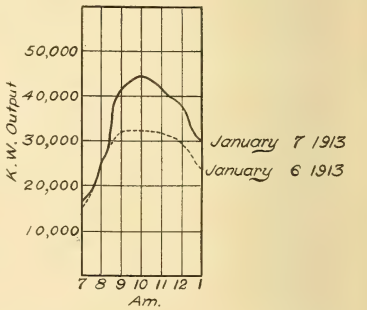
In transforming the skeleton into a man or woman or in changing the man into a woman, or vice versa, they must both work their arms briskly in a zigzag or circular motion while the transformation is taking place in order to give an out-of-focus or dissolving effect. By doing this, one form seems to gradually dissolve and fade away as the other mistily comes into view.

So great an effect did this illusion create upon the minds of the Hindus when the late Mr. Kellar performed it before them while in India, that they believed him to be supernatural. They asked him to stay, offering every inducement, which he refused. They then attempted to force him to do so and it was only after threatening that he would turn all their rivers into blood and wine—a trick they had seen him do with water in glasses—that they, through abject fear of his great power, allowed him to go.

It is a truth that no other illusion so simple, yet so comprehensive and so astounding, has ever been produced, or has given rise to such general appreciation on the part of the theater-going public. It has shown and proven to the "men behind" the value of proper —I might say—exact lighting to the mysterious art of the magician when backed by his elusive mirrors and electricity, and lastly but not least the skill of the stage electrician.

The Weather and the Output Curve

An interesting example of the dependence of a large city community upon electric lighting is illustrated in the accompanying diagram showing the amount of energy required at the South Boston station of the Boston Edison Company at



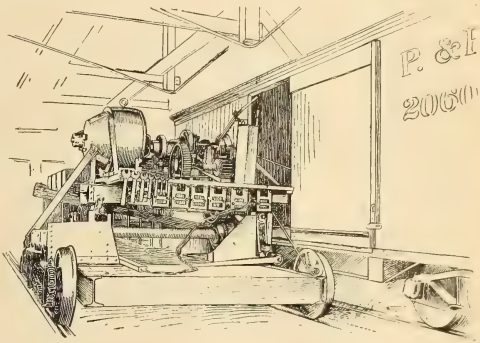
OUTPUT CURVES FOR TWO SUCCESSIVE DAYS

the same hours on two recent successive days, one of which was characterized by one of the darkest mornings in the history of the city. About 8:30 a. m. a sudden pall of fog and darkness settled upon the central portion of the Boston district, and inside of an hour the consumers of electric lighting service called for the equivalent of 480,000 tungsten incandescent lamps of 20 candlepower rating. The company met the demand upon its great turbine station with comparative ease, although the output suddenly required was larger than the total capacity of the next largest installation in the state. About 16,000 horsepower was required in excess of the amount needed at the same hour on the previous day.

Box Cars Loaded by Motor

While freight houses and large shipping concerns usually load and unload heavy freight on flat cars and gondola cars by the use of overhead cranes, box cars must usually be laboriously loaded and unloaded by men.

A large manufacturing company which daily receives and sends out a number of box cars of heavy pieces of freight has recently installed a novel and efficient loading machine for handling box car freight. As the illustration shows, the machine is on wheels that run on tracks between the cars and the shipping and receiving platform. A motor operated gear controls a long arm of structural steel which reaches into the car door; to this arm the pieces of heavy freight are attached, or if the pieces are small, a large scoop or platform can be attached.



MOTOR DRIVEN BOX CAR LOADER

The Bothersome Ohms

It is related of a certain man who had purchased an electrical machine, that not being able to put it together, he telegraphed to the manufacturer: "Machine shipped carelessly. One hundred and ten volts missing." A similar ignorance of electricity was exhibited by a passenger on a trolley car not long ago.

The car stopped in the middle of a field, early in the afternoon of a blazing hot day. Both motorman and conductor tried in vain to find out what the trouble was. At last they gave it up, and the conductor started down the track to the nearest telephone.

"What do you suppose is the trouble?" asked a passenger of the man next to him.

"Well," said the other, "I don't know much about electricity, but I should say it was the ohms. You see, they get into the wires every little while and cause an awful lot of damage there. Technically, I believe, it is called resistance, but all it amounts to is stoppage—like eels in water pipes, you know. I never saw an ohm myself—they're microscopic, you know."

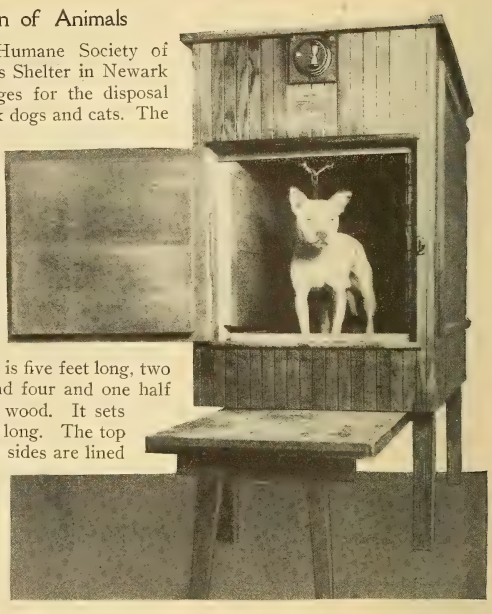
Ignition of Fire Damp by Breaking Incandescent Lamps

The English Bureau of Mines has been making experiments to discover whether fire damp can be ignited by the breakage of the bulb of a small incandescent lamp. The matter is of importance on account of the number of small portable electric lamps with tungsten filament which are now being used in mines. In the experiments the lamps were broken in a mixture of natural gas and air in the proportion of 8.0 per cent of gas, and 91.4 per cent of air, which is the most explosive mixture. The report states that in the majority of cases ignition did not occur, which would lead to the belief that ordinarily the filament will not retain its heat long enough after the breakage of the globe to ignite the surrounding gas.

Humane Destruction of Animals

Six months ago the Humane Society of New Jersey installed at its Shelter in Newark two automatic electric cages for the disposal of stray, homeless and sick dogs and cats. The fact that these devices seem to represent the most humane method of destroying life that is so far known should commend their use to every humane society and humane worker.

One of these cages is for destroying dogs, the other for disposing of cats. The dog cage or box is five feet long, two and one half feet wide and four and one half feet high and is made of wood. It sets upon legs eighteen inches long. The top of this box is of glass, the sides are lined with wood, and on the the bottom is a metal pan connected to one side of the circuit. To a metal bar on each side of the inner cage is connected the other side of the electric circuit. From these metal bars depend two strong spiral springs with metal hooks at the lower ends. The current is controlled by means of automatic contacts when the door is opened and closed.



ELECTRIC CAGE EMPLOYED BY THE HUMANE SOCIETY OF NEW JERSEY FOR DESTROYING DOGS

In operation a metal collar is put about the dog's neck, he is placed in the cage and the hooks are snapped into rings in the collar and the door closed. Instantly the dog drops unconscious, while a sand glass on the outside of the cage marks the time. No one can touch the inner cage when the door is closed but the whole operation may be watched through the glass top.

The time usually found necessary for the destruction of life in dogs is 30 seconds. If any signs of life appear the animal is immediately put back and current again turned on. Experts say, and this is verified for the Humane Society by its president, James C. Corlies, D. V. S., that unconsciousness is instantaneous, and, as the inventor affirms, "unaccompanied by surprise, fear or pain."

The cat cage is smaller—27 by 16 inches—and set at table height for convenience. The outer box is of wood and inside is a box of slate insulated from the outer box. The inner box has electrodes on the bottom. The current here is also controlled by opening and closing the cover. The operator can lower and lift this by foot action by means of a treadle, pulley and cord. The cat is placed in the box, the fore feet on one electrode, the hind feet on the other, and the cover is quickly dropped.

While in the case of the dog, uncon-

sciousness is instantaneous, the time allowed for destroying cats is one minute. Just why a longer time is necessary for the cat than for the dog is not known. Perhaps it is greater inherent vitality, differences in contact caused by density of fur, or greater body resistance to the electrical current.

Animals electrocuted show no appearance of having suffered as in the case of most other methods. They lie relaxed and as if asleep except that their eyes are open, and a return to consciousness will never take place if the apparatus is properly handled.

The Humane Society of New Jersey is one of the first societies to use the automatic electric cages and gives its hearty endorsement to them.—ELLA SKINNER BATES.

Copper Refining Plant in Montana

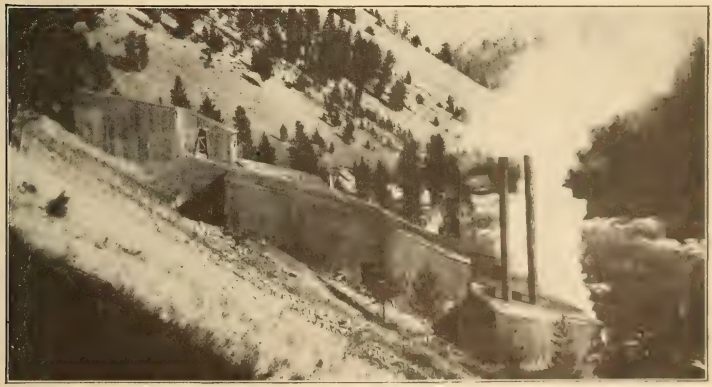
Near Phillipsburg, Mont., there is a little copper refining plant tucked away in the hills that is daily extracting copper from the crude ore by practically the same process as that employed at the Aamdal works in Norway, described in the January issue of this magazine. In addition there are now two other plants being constructed at Butte, Mont.

The carbonate ores are mined far up on a steep side hill from whence they are sent down a steel lined chute to crushers which crush the ore to an average diameter of three quarters of an inch. The ore is then dumped into large shallow tanks where sulphuric acid and water are poured on it. The resulting solution is tapped off at the bottom and runs to temperature tanks where it is heated to about 40° C. From thence it goes to the electrolytic tanks where a current of 9,000 amperes is passed through it using lead anodes and copper cathodes.

The solution runs from these tanks to a large receiving tank from whence it is pumped up and passed over the ore to gather more copper.

Every receptacle the solution comes in contact with must be lead lined, and the pump is of hard rubber.

The electricity is generated by three generators of five volts, 3,000 amperes capacity and driven by steam power, coal being hauled by teams from the railroad station 3½ miles away.—H. H. HANSEN.



AN ELECTRIC COPPER REFINING PLANT IN MONTANA

Copyright by Haddon Fawcett

FALLS OF THE RIVER ERNE AT BALLYSHANNON—A TYPICAL SOURCE OF WATER POWER IN IRELAND

Bright Future for Electric Power in Ireland

That the dormant electrical resources and opportunities of the Emerald Isle have not been more fully taken advantage of heretofore does not indicate any lack of appreciation of the possibilities, but rather the handicap of adverse circumstances. Until within the past few years Ireland, through no fault of her own, has suffered from commercial and industrial blight, but now a brighter era is dawning and one of the first manifestations of the regeneration of Erin is found in the inceptions of projects to utilize Ireland's splendid water power for the generation of electrical current.

The land of the shamrock is the natural storehouse of deposits of peat that would afford fuel for generations for all the electrical power plants that the island could be expected to require, but such is Erin's prodigality of resources that it will not be necessary to rely upon the turf fuel to any extent. Water power Ireland has in abundance and it is so distributed that there need be no long transmission of the electrical power generated. The whole country is a network of streams and rivers and lakes and a considerable portion of the island is mountainous with the result that the streams have a fall that renders them specially well adapted to generating electric power. This is the situation in the southwest of Ireland and all along the west coast where electric power is to be introduced in the famous marble quarries of Connemara.

A typical example of the transforming power of electrical energy is seen at the town of Ballyshannon in the west of Ireland. Ballyshannon is not particularly advantageously situated from a commercial standpoint, but she enjoys the boon offered by the falls of the River Erne, a cataract 150 yards in width and sixteen feet in height, and the result is a progressive, up-to-date industrial town with the prospect of rapid progress in future.

This northwestern section of Ireland in which Ballyshannon is located offers another rich opportunity for electrical power in the narrow gauge or so called "light railways" which are the sole means of transportation in this district. These railways are at present equipped with steam locomotives, but it is predicted that at no distant day the entire system will be electrified.

In this connection it may be noted that the larger Irish cities such as Dublin, Belfast, Galway, etc., are well provided with electric railways, the double-deck cars being the approved form of rolling stock. It may be of interest to add that in Belfast, where the tramways are owned and operated by the city corporation, the municipality builds all its own cars but the trucks and electrical equipment are imported from the United States. In the south of Ireland, notably in the Lakes of Killarney district, there would appear to be a harvest awaiting the promoter who will build electric scenic lines such as the Gorge Road at Niagara. Until recently the beauties of this Killarney fairyland could be enjoyed only by means of a coach tour. Within the past year or two sightseeing automobiles have been introduced but they are not an emphatic success nor can they handle the increasing traffic as could an electric line.

And speaking of electric railways in Ireland, although advance has been slow in an electrical sense, she claims the distinction of possessing one of the first successfully operated electric railroads in the world. This pioneer line is several miles in length and connects the town of Portrush in northern Ireland with the Giant's Causeway, one of the wonders of the world. This Irish electric road was built in 1883 and was designed by the late Sir William Siemens, the famous German electrical engineer and manufacturer. It has been in practically continuous operation ever since, but its original primitive and picturesque third rail installation has long since been replaced by an ordinary overhead trolley. Electrical engineers with imagination claim that the road at the Giant's Causeway ought to be extended all the way to Belfast along the Antrim coast route, thus affording another scenic ride that would rival any of those which may

ONE OF THE CURIOUS NARROW GAUGE OR "LIGHT RAILWAY" TRAINS OF NORTHWESTERN IRELAND. THERE IS TALK OF ELECTRIFYING THESE LINES

now be made on the suburban electric lines which radiate in all directions from Dublin.

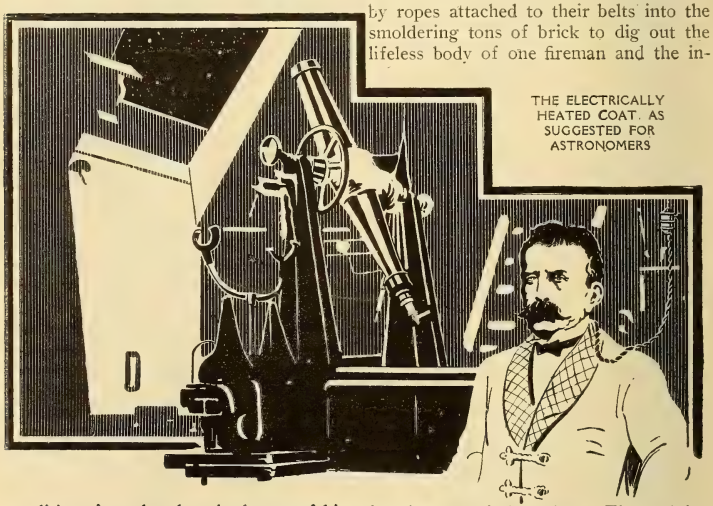
An influential factor in behalf of the electrical development of Ireland is found in the interest of Marconi, who has his principal wireless station at Clifden in western Ireland, and who, having married an Irish woman, is taking more than a casual interest in the country. Several Americans, including Richard Croker, who has built a mansion some nine miles from Dublin, are also interesting themselves in industrial projects which embrace the development and utilization of electricity.

Heated Coat for Astronomers

The astronomer in his observatory is often obliged to work in low temperature conditions in order that the lenses of his instruments may not cloud up with condensed moisture.

An electrically heated coat has been suggested for his use. Such a coat to all appearances resembles an ordinary house coat, but is made in the same manner as a heating pad of an electric blanket. A fine wire is woven about between the lining and outside cloth of the coat. This wire is heated by current but there is no possibility of a shock, as the wire is well insulated.

The accompanying illustration shows an astronomer wearing a coat which is connected to the circuit by a flexible cord and plug.



THE ELECTRICALLY HEATED COAT AS SUGGESTED FOR ASTRONOMERS

Electrician Heroes

Mr. Chas. Sanges and Mr. Frank Nettles, both electricians of the Mobile Electric Company, Mobile, Ala., displayed rare bravery Thursday, January 9th, in rescuing two firemen who had been buried beneath the débris in a fire which destroyed the Mobile Theater. These men, at the risk of their lives, were lowered by ropes attached to their belts into the smoldering tons of brick to dig out the lifeless body of one fireman and the injured body of the other. The red hot bricks were removed and the two taken out from among the red hot ruins. Although burned and blistered, the linemen went back to their work, after receiving medical attention, and resumed their daily duties just as usual.

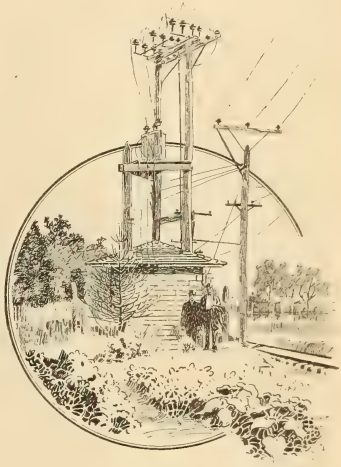
An Ideal Electric Plant on a Farm

Located about two miles outside of Marietta, Ohio, on the banks of the Muskingum river, is what one might consider almost an ideal farm. It is owned by Mr. W. W. Mills, a Marietta banker, who is also vice-president of the Parkersburg, Marietta and Interurban Railroad Company. This company, in addition to operating the railroad between the cities of Parkersburg and Marietta, also supplies light and power in these cities.

The farm consists of about 60 acres of very valuable land, approximately one-half of which is located along the river bank and is of the very richest kind of soil. Mr. Mills decided some time ago to have a modern and up-to-date farm, and selected this locality as being specially suitable. The trolley road runs parallel with the river and directly through the farm, so that it affords excellent transportation facilities to and from Marietta and Parkersburg.

Wishing to avail himself of all modern advantages, Mr. Mills naturally turned to his own company for suggestions as to the possible use of electricity on the farm. On consulting with the general manager of the P. M. & I. Company, it was found that it was possible by use of outdoor type apparatus to secure the electric energy at a very reasonable expense. All that was necessary to do was to tap the 22,000 volt transmission line which runs past his farm, install a transformer and switching apparatus and use the current in various applications on the farm.

The accompanying illustration shows clearly the simplicity of the installation, which consists of a standard Westinghouse outdoor type transformer, giving 110 or 220 volts on the secondary. The small building contains the switchboard, a watthour meter for measuring the energy received and the auto-starter for a ten horsepower motor, which is located about 1,200 feet away on the river bank. The motor is used for pumping water into a tank located just back of the house. When desired, it can also be used for irrigating the truck farm, an operation accomplished by means of several valves which can be opened and the water allowed to flow by gravity through some



FARM TRANSFORMER STATION

piping which is perforated at intervals, thus spraying the water over the land.

Appreciating the desirable features of electrical devices in the home, advantage was taken of the electrical installation to light the residence and equip it with the many modern electric devices that do so much to make home life easy.

This installation has proved conclusively to the officials of the railroad company that it is entirely feasible to tap, for power and lighting purposes, the transmission line which had heretofore been used only for supplying energy to the railway. By this means, it is possible to supply a number of villages and small towns along the line of railway, and thus derive a very considerable revenue at a small outlay.

Boston's Articulated Trolley Car

The Boston Elevated is making some experiments with an articulated car as a means of solving the problem presented by the many sharp curves on the tracks of the Boston street cars.

Boston, in the 1600's, was but a village nestled on the slopes of Beacon Hill and connected with the village of Roxbury by

ARTICULATED TROLLEY CAR

a narrow neck of land extending across the small bay. This "back" bay was gradually filled in during modern times, but with all the modernizing, the erecting of brick and stone structures, it is a remarkable fact that the same old crooked paths of the original hamlet of Boston were preserved.

The new car has been devised by the company itself at its Bartlett Street plant and if the car proves satisfactory, it will then be manufactured outside and put into general use on the Boston trolley system.

The articulated trolley car consists of two of the old style "bobtail" trolleys, hinged onto a small platform car. Thus 150 to 200 persons can be carried at one load and the train is so broken up that a very short curve can be taken.

The World's Greatest Battleship and Her Electrical Equipment

From the crude generator and scant electrical equipment of the old steam frigate *Trenton* to the installation on the modern dreadnaught *New York* runs the history of electrical appliances in the United States Navy. The ill-fated *Trenton*, wrecked in a hurricane at Samoa in 1889, was the first American vessel to be lighted by electricity, the installation being made in 1885 under the supervision of Rear Admiral Royal Bird Bradford, then a lieutenant-commander.

Quite different from that of the ship of the present day was the lighting apparatus of the old wooden ship, for her lights were installed at a time when commercial lighting on land was in its infancy. Current was generated by a bipolar machine and supplied light only. The *New York,* the very latest of Uncle Sam's fighters, will, when she is commissioned next Fall, have electrical machinery for everything except the actual driving of her propellers, current being supplied by four 300 kilowatt generators.

In the first place there will be the ship's lighting, some 2000 sixteen candlepower

incandescent lamps and 42 mercury vapor arcs being required in addition to the sixteen 36 inch searchlights and the lamps on the semaphore arms and of the Ardois system.

From his place on the bridge the navigating officer will control every movement of his ship, for a system of telephones, speaking tubes and bells puts him in instant communication with every part of the vessel from the tops of the fire control masts to the dingiest stoke hole. In addition to this lighting apparatus and signaling equipment there will be electric motors to perform every task on shipboard.

At the turn of a lever on the bridge a great motor of 50 horsepower will swing the rudder to keep the vessel on her course. In battle it will be motors of 50 horsepower that hoist the powder and shells from the magazines to the turrets of the fourteen inch breech loading rifles, another motor of three horsepower will open the breech and one of fifteen will ram the charge home. Others of 25 and fifteen horsepower will swing the turrets to port or starboard and elevate and depress the guns and when all is in readiness an electric spark will explode the powder and hurl the shell on its mission of destruction.

While the five great turrets, each with its pair of fourteen inch guns, will be handled by this elaborate electrical machinery, the 21 five inch guns of the secondary battery will be handled entirely by hand, the members of the gun crews swinging and elevating the rifle by means of wheels, although the ammunition will be brought up from the magazines far below the water line by means of three horsepower electric hoists.

In addition to the motors for the ship's fighting machinery there are the great electric cranes for all the heavy hoisting. They will pick a steam launch and its crew out of the water and deposit it anywhere on deck, a 50 horsepower motor hoisting the load and one of half that power turning the crane from side to side. A 35 horsepower motor will turn the capstan to haul the anchors to the deck and a deck winch of the same power will be provided for hoisting stores out of the hold. Motor driven pumps will keep the ships' fresh water in circulation as well as supply the standpipes from which the ship is washed down with sea water. Forty-four ventilating sets will provide fresh air and 35 horsepower blowers will supply forced draught when necessary.

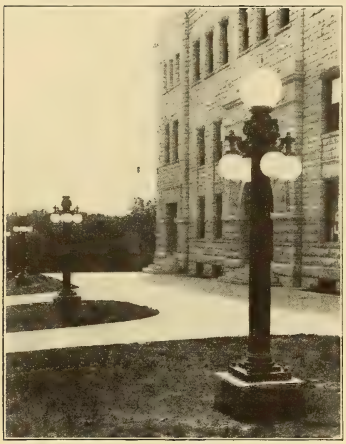
In the ship's galley will be an electrical installation that will be a radical departure from former practices, for the old kitchen range with its dirt and ashes is to be displaced by an electric oven. In this oven all the bread will be baked and a ship crew now requires thousands of loaves a week. There will also be a complement of culinary tools that will do all the tasks that the jackies used to do when they wanted to gain the cook's favor. These appliances will peel potatoes, slice bread, beat eggs, mix dough, grind and slice meat, wash dishes at the rate of 6,000 pieces an hour, freeze ice-cream and operate a refrigerating machine that will not only preserve the food in the store rooms, but will pump brine through a system of pipes encircling the magazines, thus keeping them cool and reducing the danger of combustion to a minimum.

Such in brief is to be the electrical equipment of Uncle Sam's newest fighter, the *New York*, launched at the Brooklyn Navy Yard last October. She will be completed in time to take part in the mobilization of the fleet next fall and will be the largest war vessel in commission. The *New York* will have a speed of 21 knots, a displacement of 27,000 tons, a length of 575 feet and a beam of 95 feet. Her crew will consist of 64 officers and 1,000 men and in the crew will be about 40 expert electricians, men trained in the government electrical school at the Brooklyn Navy Yard and fitted especially for the peculiar requirements of caring for a fighting ship's intricate electrical machinery.

College Class Leaves Memorial

In many universities and colleges the graduating class leaves behind a memorial to perpetuate its memory. This custom prevails at the Kansas State Agricultural College, Manhattan, and the class of 1912 arranged to "so let its light shine" that it will be remembered for all time.

The memorial, costing $600, consists of four bronze finished electroliers set



A USEFUL AND ARTISTIC CLASS MEMORIAL

upon metal posts along the walk fronting the auditorium. Each electrolier is fitted with five globes—one large sixteen inch center globe and four ten inch globes supported on side brackets. A 150 watt Mazda lamp is used in the large globe and 40 watt Mazdas in the small ones.

Each post is set on a square cement base, making the uppermost lamp twelve feet above the walk. The current for lighting is furnished by the college power plant, being 220 volts, direct and is carried to the posts by steel-armored lead-encased cable laid directly in the ground.

The arc lights shown in the picture attached directly to the building and formerly used for lighting have been removed.—V. E. Miller.

Electric Charge on Rain

In the proceedings of The Royal Irish Academy for Sept., 1912, are described the experiments of Messrs. McClelland and Nolan on the electrical charge on rain. Of the total amount of rain collected 82.6 per cent was found to be positively charged, while, of the total amount of electricity brought down, 76.9 per cent was positive. Tables giving the results of each month show that the charge per cubic centimeter of rain tends to be lower in the winter than in summer.

The rain was separated into three types—fine, large and mixed rain. Large rain is always highly charged, the average charge being one to two electrostatic units per cubic centimeter. The largest charge per cubic centimeter was one of 12.3 electrostatic units on March 5, 1912. Mixed rain is weakly charged. On both of these types positive electricity predominates, but fine rain is always negatively charged.

Tables are given showing the current per square centimeter of the earth's surface brought down by the rain. Summing up, the authors say that there is no doubt that a large excess of positive electricity is brought down to the earth's surface by rain. Their experiments show that the rain occurring during normal elecrical conditions is charged, generally speaking, in a similar manner to thunderstorm rain.

Where Carbon Boils

It is held that when an electric arc light hisses, the carbon, melted from one of the rods, is actually boiling in the little crater formed in the end of the rod. The superheated liquid, with blinding flashes of light, moves and jumps about very much as water does on beginning to boil.

Modern Interurban Stations

The small wooden structure is a type of station frequently found along interurban lines serving as a waiting room. Only a few months ago this type of station occupied the spot on the Aurora and Elgin Interurban Railway where is now located the imposing brick structure shown in the large picture. The favor of the public toward the electric railway particularly in winter and the consequent increased patronage due to freedom from smoke, dirt and unreliable service common on steam roads account for the building of substantial accommodations for the public.

A MODERN INTERURBAN STATION IN CONTRAST TO THE OLD WOODEN STRUCTURE

This imposing and modern station is divided into general and separate waiting rooms with conveniences. The large French windows and porches give an air to the station entirely different from that of the stuffy place with which patrons were more or less familiar and can but make for the popularity of electric interurban service.

Electric Bells Rung by the Sun

Professor Köhl, of the Odder Observatory, Denmark, reports that when the huge sunspot of September last was crossing the solar meridian, magnificent auroral lights flashed across the heavens and the electric bells in the great telegraph station at Frederica rang without any visible cause. The telegraphic service in Denmark was disturbed for hours during the auroral display. Professor Köhl thinks that the agency of the sun in producing the phenomena was evident. Similar exhibitions of "wireless telegraphy" between the sun and the earth have been noted in the past, when electric currents at pressures of several hundred volts have been noted in the telegraph lines all over the world.

By GEORGE F. WORTS

Without going into further personal details let it suffice to say that Mr. Jones typified the average American business man. At 10 a. m. he sat in his office smiling knowingly over the following note from a friend:

"Dear Jones," it ran, "big poker party on at the club to-night—sky the limit as usual. Phone your wife the 'Sick Friend' story and—"

At this juncture Mr. Jones reached for the 'phone to call his wife. He lifted the receiver from its hook on the tapering nickeled pedestal and put it to his ear. At the end of the fourth second, precisely, when "Central," by established precedent, was scheduled to break the monotony with a crisp "Number please!" Mr. Jones commenced to fidget. "Why, what rotten service," he muttered. He clicked the hook up and down with his forefinger impatiently. Nearly a quarter of a minute passed. His face became flushed and his eyes fairly bulged with rage. He rumpled his hair with his disengaged hand, unconsciously augmenting an already superb dramatic effect. By this time he had forgotten entirely the ingenious little tale he had cracked up for his wife.

Meanwhile, confronted by a sudden spurt in the number of calls, due to a grave slump on the stock exchange, "Central," who had been striving valiantly to hold her own against this unexpected burden, picked up a switchboard cord—one of the arteries through which flowed an endless traffic—and answered in its turn the flickering dot of light on her switchboard which indicated Mr. Jones's rising wrath.

"Number please?" she asked sweetly.

"Number!— Number!!" shouted the furious voice of Mr. Jones over the wire. "Why—blankety blank it! I've been waiting here over half an hour—" etc. Figuratively speaking, the wires fairly writhed and sank under the weight and substance of Mr. Jones's words. Central, who, as usual, was a sensitive young girl, was compelled to sit quietly by, mind you, and listen with an ear pink with shame to the unstemmed flow. She beckoned for a supervisor and the supervisor listened, too, for a time, with the color mantling her cheeks, to Mr. Jones's caustic opinion. In despair and disgust she finally switched the connection to a cooler wire—that which led to the manager's office. Mr. Jone's anger, it seems, was a sort of a regenerative affair and did not falter until the brisk voice of the manager interrupted with a "What is the trouble please?"

Mr. Jones gasped in astonishment, but upon gaining the indentity of his auditor—completed the citation of his grievances.

The manager apologized for the poor service, explained the temporary cause and promised that such a lapse would not occur again if he could help it and then, upon inspiration, he suddenly asked:

"Mr. Jones, exactly how do you consider 'Central'—as an integral part of a well oiled machine which, for some unavoidable reason, may 'slip a cog,' as it were,—or is your conception of her a girl at a desk reading a magazine, or embroidering or talking loudly with the other girls in the room and occasionally answering a call when the fancy takes her?"

Mr. Jones was silent for a moment. "To tell the truth," he replied, "I never gave the matter much thought, although I always have had a vague idea—as you suggest—of a girl with a magazine in one hand and not paying particularly strict attention to business."

"That is exactly what everyone imagines who has never been through a modern telephone exchange," replied the manager. "Now, Mr. Jones, I will have a few minutes to spare at four o'clock this afternoon and if you can take the time from your business I would be glad to have you pay us a visit. Can you arrange it?"

HIS EYES FAIRLY BULGED WITH RAGE

Mr. Jones consulted his appointment card, saw that he would be free at the suggested time and acknowledged that he would be delighted to accept the manager's kind invitation. Punctually, at the appointed hour, Mr. Jones's card was presented to the manager. He was received promptly.

"We are always glad to have subscribers drop in and see how we run things," said the manager, shaking his caller's hand warmly. "It usually revises their conception of a telephone office a little." He led the way up a flight of stairs into a large, well ventilated room. Mr. Jones received his first of a succession of surprises.

In the room, facing a long, narrow horseshoe arrangement of desks—the switchboards—were more than 200 girls each intent upon scores—hundreds—myriads of tiny metal lined holes in the mahogany panels rising before them. No word could be heard coming from them individually, yet a low, soft, subdued murmur arose from the throng—so well modulated and controlled that it could scarcely be heard in the hall outside the open door. Little red lights winked continuously from narrow shelves below the panels. "Was this your conception?" asked the manager in a low voice He, too, seemed to be influenced by the tense, subduing effect of the room's very atmosphere. "From here, we can connect you with any place—city, town or out-of-the-way villa within a 2,000 mile circle." Mr. Jones could only shake his head in wonderment.

A trim, business-like young woman passed the manager and nodded smiling. He called to her, "Miss Rourke," he said. "This is Mr. Jones, one of our subscribers who has had a little difficulty with his service lately. Mr. Jones, let me present our assistant chief operator." Mr. Jones bowed.

"I will show you how the calls come in," said Miss Rourke briskly, "if you will step to this nearest board." The two men followed and she continued:

"When one of these tiny lamps lights up on the face of the board, it indicates that someone has the receiver up—is trying to call 'Central.' 'Central' answers the call with one of these sets of cords, of which every position has seventeen. As you see, each pair of cords has two little parallel lamps down on the horizontal shelf, associated with it, and these lamps are arranged so that they light when the talking parties hang up their receivers, so we know when to take down a connection or if a subscriber

"THIS IS THE TIME WHEN THE CLUB MEN ARE USUALLY PLANNING THE SICK FRIEND STORY"

wants to make another call or ask a question.

Those little round holes in the board, known by us as jacks, and which the girls face, are arranged in mathematical order, 20 to a strip and each jack properly numbered so that a girl can at once pick out any number called.

"Do you mean that any girl can call any number without requiring the assistance of any other girl?" Interrupted the surprised voice of Mr. Jones.

"Exactly," she replied. "That is, the young ladies here can reach any number terminating in this office. Calls for numbers into other exchanges about the city have to be connected by special order wires and trunks to the other exchanges and are completed there by operators working under similar conditions to those in the room here."

Mr. Jones looked about him. Of all the 200 girls in the room, none but was busily engaged in deftly manipulating the shining metallic plugs attached to the long flexible cords. "How do they ever keep it up?" he marveled. "No wonder 'Central' on my line took a second or so longer than usual answering this morning. I don't blame her a bit."

"From nine to ten in the morning and from four to five in the afternoon are the busiest hours," the assistant chief operator was saying. "Traffic is lightest from midnight until dawn. Then is the time the club men are usually 'phoning the 'Sick Friend' story to their wives."

Mr. Jones underwent a twinge of conscience and he observed that the manager, too, winced.

"I didn't think there were that many liars in the city," whispered Mr. Jones to the manager. "Perhaps they're not all club men," condoled the manager.

"Some of the girls are so expert that they can tell exactly what number is calling from the flashing of the light on a switchboard at the other end of the room —and they can answer from where they are sitting."

"At which board is number 5500 located?" Mr. Jones queried.

She pointed to one of the girls near by. "She would handle that call."

Could it be possible that this nice looking young woman was the one to whom he had spoken so harshly that morning? He felt suddenly ashamed.

"Her calls come mostly from the business district and often the men are impatient, but she is so sweet she rarely has trouble."

The manager pulled out a small ear receiver and connected it by a plug to the girl's board. "Listen in on that a moment Mr. Jones," he suggested "That may still further alter your conception." Mr. Jones listened. For an interval it was very confusing—a jargon of variegated voices—shrill sopranos, rasping tenors and harsh bases constantly punctuated by the sweetly modulated voice of "Central" with "Number please." "Line busy," "Calling your party" and the many other expressions current in telephone parlance. Always brief, yet invariably polite was her response. As Mr. Jones was about to return the instrument to its owner he heard in answer to the usual "Number please?" a coarse, masculine voice exclaim:

"Hello Honey! How's the little—"

"You have the wrong party," interrupted the little operator firmly. "This is *not* a beehive. Number please?" The amicably inclined gentleman at the other end hesitated and probably blushed—at least Mr. Jones hoped he blushed—and then, in a perfectly subdued voice, gave the number he desired.

Behind the operators' chairs, pacing ceaselessly—vigilantly—back and forth, were the supervisors. Much like caged lionesses, Mr. Jones thought, although they were probably somewhat more gentle. It is their duty to help in rush moments, to instruct beginners and, as the name implies, to supervise—incidentally to settle complaints and maintain order among the operators. They are the sub-bosses. In the center of the room were the "Information" desks. To the rear was the chief operator's office, at the desk in which a decidedly capable appearing young woman sat, glancing over some pay rolls.

"Positions as telephone operators in large exchanges offer good opportunities for girls," remarked Miss Rourke. "The hours are comparatively short; the work, when once learned, is quite easy—merely a matter of second nature—and could almost be done with one's eyes closed; the chances for higher pay and promotion are good; the employment is respectable and honorable and the experience is broadening. All in all it is a good field for an ambitious working girl—much better to my mind than the ordinary business office, not to speak of the factory. However, I think the home and not the office is the place for girls, but that is another story. I? No, I am not a suffragette."

"I am sure," she said in parting, "that you will be inclined to be a little more lenient with the girls if they are a trifle slow in answering your calls—after having visited our exchange. Although," she amended apologetically, "I presume you would never be impatient with them."

"Heavens no, never!" assured Mr. Jones.

An Electric Mail Carrier

An interesting device for the prompt delivery of letters to the tenants of the upper floors in lofty houses is employed in Geneva. On the ground floor is a letter box for each of the floors above. When a letter is dropped into one of the boxes, it makes an electric contact, which not only sets a bell ringing on the floor for which the letter is intended, but also opens the valve of a water tank on that floor, by means of which a cylinder, connected with the letter box by cords and pulleys, is filled with water. When full, the cylinder descends and pulls up the letter box. The latter, on reaching its destination, automatically dumps its contents, while at the same time the cylinder discharges its water. The box now out weighs the cylinder, and accordingly descends, lifting the cylinder

Ozone in Tunnels of Central London Railway

By FRANK C. PERKINS

For the past decade the Central London Railway has been ventilated on the exhaust system, the method consisting in closing all the doors underground for a certain period after the running of the last train, and drawing air right through the tube from one end to the other by means of a 200 horsepower exhaust fan fixed at Shepherd's Bush. This thorough cleaning out every night was supplemented by a continuous running exhaust fan at the British Museum Station and the natural ventilating action of the running trains. On account of the increasing traffic, directors of the railway decided to install a more positive system of ventilation and the management decided to adopt an elaborate equipment to provide a continual influx of ozonized air during the whole of the day. This new installation of the Ozonair type was installed under the direction of E. P. Grove, Chief Engineer of the Central London Railway.

The Central London Railway runs from Wood Lane on the west side of London to the Bank of England in the center of the city, a distance of nearly seven miles and comprises two separate tunnels, having an aggregate length of about thirteen miles. With the exception of a very short length between the first two stations—Wood Lane and Shepherd's Bush, the railway is entirely underground. The "up" and "down" lines are in practically separate tunnels, each eleven feet eight inches in diameter, pierced in the London clay and formed of segments of cast iron bolted together. These tunnels are interconnected at several points by crossovers.

During heavy traffic there are some 25

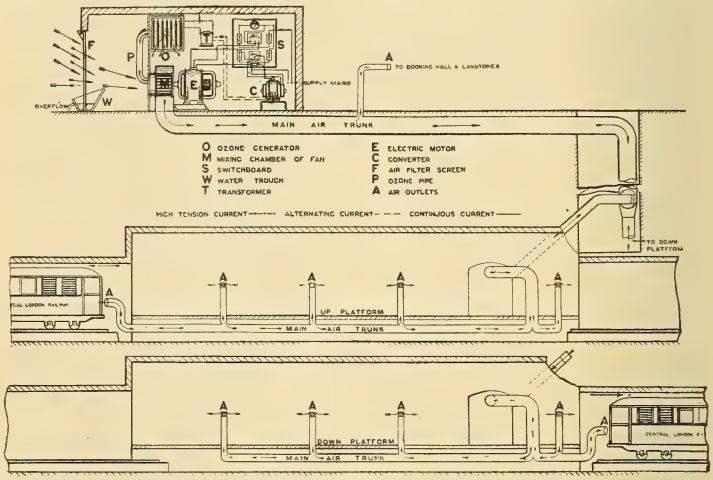


DIAGRAM SHOWING THE "OZONAIR" SYSTEM IN THE TUBES OF THE CENTRAL LONDON RAILWAY

During heavy traffic there are some 25

or more trains in the tunnels at the same time, each of which carries 300 people more or less. Assuming that the trains are on an average three-quarters full, it will be seen that there are every day over 6000 people in the trains, or including those on the platforms and lifts there may be as many as 10,000 in the tube continuously for two or three hours, and four or five thousand all day, so that the necessity for thorough ventilation is obvious.

The installation for the ventilation of the railway tubes on the Ozonair system is unique and consists of a separate and independent plant at each station; with the exception of Shepherd's Bush, which is near the open end of the tunnel. The explanatory diagram illustrates graphically the general arrangement of one of these plants, and shows how the air is purified ozonized and introduced into the tunnels. The actual generating plant is shown in the small room on the upper left hand side of the diagram. Commencing on the extreme left is the filter screen (F) which cleans and washes the incoming air from all dirt and smuts, and at the same time absorbs all the deleterious gases, such as ammonia and sulphurous acid, which are always present in the atmosphere of large cities. The air is drawn through the filter screen by aid of a fan (M) which is driven by a powerful electric motor. The screen is kept moistened by means of a continual flow of water from a series of jets at its upper edge. The used water is caught in the water trough (W).

The ozone generator is shown at (O). The pattern supplied to the Central London Railway consists of a series of ten generating units, each comprising a thin mica plate with a sheet of metallic gauze on either side, the set of ten plates being spaced and mounted on insulating supports. The gauze sheets are connected across the secondary of a small transformer delivering alternating current at a pressure of several thousand volts, and an innumerable number of minute discharges occur all over the opposing surfaces of the plates. These discharges convert the oxygen of the air into ozone. In view of the very large volume of air dealt with in the Central London Railway plants, a comparatively strong mixture is produced in the ozone generator and this conveyed by the ozone pipe (P) to the mixing chamber of the main ventilating fan (M), where it is mixed with the main current of air, and thence blown down the main air trunk to the various distributing sheet metal ducts or conduits.

DUCT FOR CARRYING OZONIZED AIR IN THE LONDON "TUBES"

These air outlets are marked (A) on the diagram.

Most of the Central London Railway equipments will pass normally some 360,000 cubic feet of air per hour, and the generator provides an amount of ozone sufficient to preserve the proper proportion. It is stated that the main ducts in the case of the normal equipments are about three square feet in cross section and are all constructed of galvanized mild steel.

It is said those who travel on the Central London Railway fully appreciate the advantages of the purer and fresher air now provided for their comfort, an advantage that more than ever differentiates this railway from others, and thus encourages other people to make an even greater use of it than they have done in the past. Whether it be in the cold, clammy weather of winter, or in the excessive heat of summers height, travellers in the Central London Railway Tube are neither too cold nor too hot, for its temperature is practically uniform all the year around. To this feature is added the freshness and purity of the air of the mountain top.

For Transporting Lamps

We illustrate a new Paris idea in the way of transporting incandescent lamps and it is claimed to be much safer and give less breakage of the glass or filament than usual. It is curious to note that the Ovigarde method was first put in use for handling eggs, and it was such a success that the next step was to apply it in packing lamps. Here it proves better than what was used before for the purpose, such as cotton, corrugated pasteboard or cell-boxes.

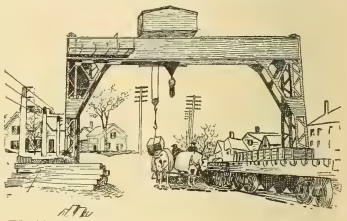
CASE FOR TRANSPORTING LAMPS

The packing shell is of thick corrugated paper, molded by pressure into the right shape and it has the form of the lamp so that it guards the lamp on all sides, as will be noticed. It may be asked how the lamp is put in. This is done by simply opening out the overlapping edges of the slit running down one side, which then spring shut again when the lamp is inside.

At the top is a small expanded end which serves to surround the fragile point of the lamp so as to protect it well. Lamps fitted with this cover can then be packed into any kind of a box just like ordinary pieces, and will stand all kinds of shocks. The new packing is quicker and cheaper to handle, weighs less and takes up less space.

Crane Service at a Way Station

Electricity is being used more and more to facilitate the handling of freight at large railroad terminal stations, but its possibilities in small cities and towns are as yet only slightly realized. A somewhat unusual installation is located at Quincy, Mass., from the point of view of crane capacity at a small way freight depot.



TRANSFERRING FREIGHT AT A WAY STATION

As shown in the accompanying drawing the equipment consists of a 40 ton Shaw crane operated back and forth upon a wide runway inclosing a teaming road and train track facilities, so that the quickest transfers may be made between the trucks and the cars.

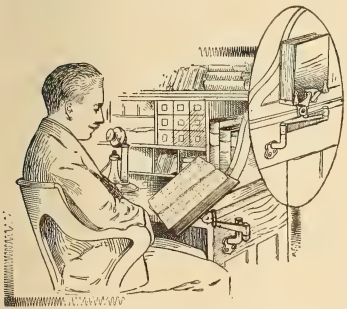
Current is supplied to the crane by contacts running upon three horizontal trolley wires located at the side of the runway, and the service is furnished by the local electric service company. Out of Quincy are shipped yearly many carloads of granite quarried by electric power in the adjacent hills, and since the installation of the crane the promptness of shipments and the cost of handling have clearly shown that the use of motors is by far the best method of taking care of heavy work of this kind.

Experiments with Selenium

The photoelectric properties of selenium are well known. Some experiments have been made in Germany on a crystalline form of the metal obtained by heating it to 217° C. and cooling it rapidly. The results show that the photoelectric sensitiveness of the crystalline selenium increases after the time of preparation, especially if kept in the light; the sensitiveness is increased by positive electrification at low pressures, but reduced by negative electrification in the open air. In the case of noncrystalline selenium, which has a higher sensitiveness than the crystalline variety, the sensitiveness is reduced by light and recovered in the dark. Negative electrification at all pressures diminishes the sensitiveness, while positive electrification increases it.

Telephone Book Holder

The business man has occasion to refer frequently to the telephone directory and will appreciate the convenience of a holder that keeps the book ready at the side

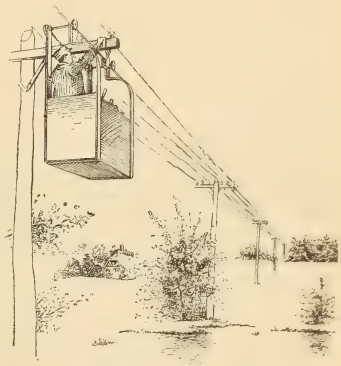


HOLDER FOR TELEPHONE DIRECTORY

of his desk. The Stromberg-Lindh telephone book holder consists of a bracket and two revolvable arms, all of metal, that secure the directory, open or closed as is desired, near at hand and accessible.

Lineman's Aerial Car

The future lineman may possibly travel in an aerial car propelled by a gasoline engine if the invention of Henry M. Preacher, Brunson, South Carolina, is put into operation. Furthermore, the lineman



THE LINEMAN OF THE FUTURE

will not need to climb poles or do any walking but will be carried along near the wires he is caring for.

Depending from the cross arms are brackets carrying a cable. From this by means of grooved wheels a car is suspended, the whole being driven by a sprocket chain connected to the engine in the car.

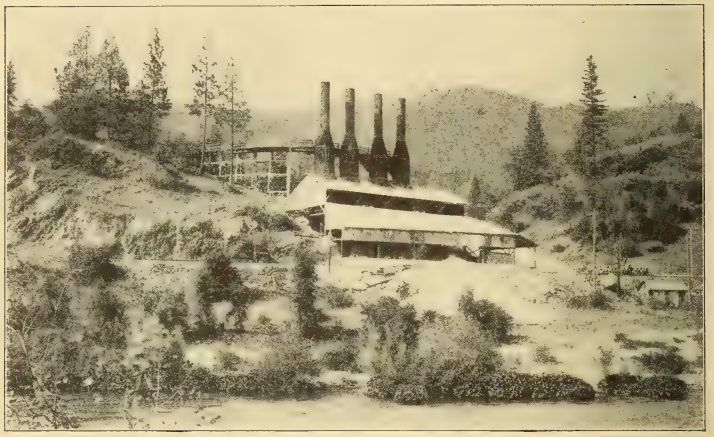
Termites Destroy a Cable

The French authorities have been investigating the matter of the destruction of an electric cable in Tonquin by the attacks of termites. The cable crossed a marshy tract and was enclosed in a tube of lead. The insects bored holes in the tube and completely destroyed the insulation of the cable. It has been proposed to guard the cable against future attacks by enclosing it in an envelope of cotton and jute impregnated with sulphate of copper, which it is believed, would prove a fatal poison to the insects.

Electric Smelter Plant in California

Dr. P. Heroult, the noted French engineer, is the designer of the electric steel furnaces at the plant of the Noble Steel Company, Heroult, Cal., a picture of which is here shown.

In the mountains back of the plant are rich deposits of magnetite iron ore and limestone adjoining each other, the latter being used as a flux for the molten bath in the electric smelters.



HEROULT FURNACES IN A CALIFORNIA SMELTER

In the beginning of Dr. Heroult's experiments five electric furnaces were sent to the junk heap. The sixth was a success and is now in use and others are being built.

The electric smelter building has a heavy steel frame and is covered with galvanized corrugated iron. It is rectangular in shape, 120 feet long and 75 feet wide. Its position is parallel to and adjoining the railroad track. The 24 inch gauge track system runs through the building with the necessary switches, turntables, etc. The furnaces are placed in a line parallel to the length of the building and will number six each with a capacity of eighteen tons per day when the plant is completed. The furnace enclosure is very simple. It is a steel box 27 feet long, thirteen feet wide and twelve feet high. The upper half of the box is rectangular but in the lower half the sides taper toward the center of the foundation. The box is lined with fire-clay on the vertical sides and a hearth of the same material slopes slightly from the sides towards the middle to facilitate the flow of the molten bath when the furnace is tapped.

The roof of the furnaces is arched and is surmounted by five stacks in a row. In the four spaces between the stacks at the center of the dividing arches are inserted the graphite electrodes which are cylindrical, twelve inches in diameter and four feet long. These are fed downward with the aid of jackscrews. Both the electrodes and the arched roof are water cooled, this feature being essential to successful operation.

A charging platform is built near the top of the stacks and carries a track.

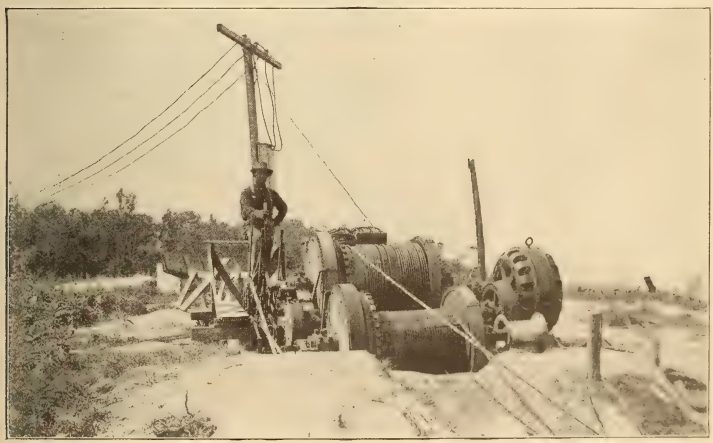
Dump cars with the charge are run along the platform and dump directly into the stacks.

The supply of current is taken from a 60,000 volt line through six 1,500 kilowatt transformers. The temperature within a furnace when in operation is around 4,200°F. but this great expenditure of heat is hardly evident to one standing beside it.

Removing Top Soil by Electric Power

The taking off of from one to six feet of top soil to expose the clay subsoil was a task a Minnesota brick and tile company found very slow and expensive by the use of horse-drawn plows and scrapers. Two teams were kept busy at this kind of work.

An economy investigation resulted in an electrically driven hoist being placed on the top of the hill; the hoist cable was attached to a large specially constructed scraper and as much of the hillside was cleared this way in two weeks as was done in two months by the former method. The illustration shows the hoist and its operator. The motor is a 50 horsepower, alternating current machine; power lines are brought up the hill from transmission lines below.



UTILIZING THE ELECTRIC HOIST TO DRAW A SCRAPER

Rutile

Very few people have ever heard of rutile. This is not strange since there is only one company mining it—The American Rutile Company at Roseland, Va.,—and it is used for unusual purposes, as for making ferrotitanium for use in the manufacture of steel, in electrodes of the "magnetite" arc lamp, in the ceramic trade and in dyeing leather and textiles. Prices range from $30 to $160 a ton according to percentage of titanic oxide and quantity. Pulverized rutile and extra pure grades sell for higher prices.

The production in 1912 was 275 tons of concentrates carrying from 80 to 85 per cent of titanic oxide. The principal impurity is iron oxide carried in an iron-rich mineral which from its black color

is supposed to be ilmenite. The ilmenite is easily separated from the rutile by an electro-magnet and 100 tons of such purified concentrate were produced which carried 94 per cent or more of titanic oxide. The separated material carries from 50 to 60 per cent of titanic oxide and as much as 42.3 per cent of iron oxide. It is especially adapted for making ferotitanium.

A Portable Photo-Telegraph

A French physician, already well known on account of his electrical inventions, Mons. Edouard Belin, has just completed a portable apparatus which makes possible photographic reporting by telephone. This scientist produced his first photo-telegraph in 1907; this, however, was not portable, as is this later one.

This new photo-telegraph, of quite small volume and weight, consists of a complete transmitter which can be connected with a telephone or telegraph line terminating at a distant station, at which are arranged the receiving instruments. The transmission depends upon the properties possessed by bichromatized gelatine. It is known that in what is called the carbon method, invented by Poitevin, photographic proofs are obtained with paper sensitized with bichromatized gelatine, which becomes insoluble when exposed to light. After taking out of the printing frame they are washed in warm water and the gelatine is dissolved more or less according to the degree of opacity of the different parts of the negative. When this is done, the proof presents a surface of depressions and reliefs which corresponds respectively to the whites and blacks of the original negative. The half tints are produced by intermediate heights which are in exact proportion to their intensities.

This proof is then put on the cylinder of the photo-telegraph, which is set in motion by a spring. The screw which winds up the spring, turning as the spring unwinds itself, causes the movement of a point in the instrument, called an "exploring point" because its purpose is to transmit the movement produced by the depressions and reliefs of the picture to the sending instrument. This latter is called a rheomicrophone, and is a box having a bottom of insulating material, and a lid composed of a flexible conducting plate which translates the variations of relief of the image into currents of different intensity on the line. For this purpose there are interposed resistances, suitably calculated, between ten contact points on the insulating plate at the bottom of the box. The current coming from a small battery reaches the first contact point, which is always in contact with the conducting plate, and passes out by the wire attached to the last point. The plate, in consequence of the pressure conveyed to it by the inequalities of the surface of the proof, touches a certain number, varying according to the pressure, of the contact points. In this way are produced successive variations of the intensity of the current sent onto the line.

Let us see now how the photograph reporter proceeds. After having finished up a negative, he takes from it a bichromatized gelatine proof, which before drying he places on the cylinder of the photo-telegraph; then he connects the instrument with a telephone line by means of binding screws. At the other end of the line his correspondent connects the ends of the wires to the receiving station of a large Belin photo-telegraph, on the cylinder of which is the sensitive paper which is to receive the photograph, this paper being protected by a hexagonal photograph frame.

Everything is ready now for the sending of the photograph. The two operators, after having sent the necessary signals, and synchronized the apparatus, begin the transmission. It may be mentioned that the putting of the apparatus on the wire does not interfere with the use of the line for ordinary purposes.

The mechanism of the receiving sta-

tion consists of a Nernst lamp, which is the source of light; it projects its rays upon the sensative surface through a Blondel oscillograph, which is an instrument for recording alternating current wave forms, and for the study of electrical oscillations. It consists of a soft iron wire upon which is a small mirror, pivoted between the poles of an electromagnet and vibrating with a frequency proportional to the intensity of the current received. The pencil of luminous rays from the Nernst lamp is thrown upon this vibrating mirror, from which it is reflected through an aplanatic lens; that is, a lens which brings parallel rays to a focus without spherical or chromatic aberration. Against this lens is applied a scale of tints, or a sheet of glass shaded gradually from left to right, from black to perfect transparency. An electric motor, running at a speed determined by the speed of the transmitting mechanism, and made to correspond with it most accurately by means of a special rheostat and a frequency meter, causes the rotation of the receiving cylinder, whose dimensions are identical with that of the transmitting mechanism, and which is enclosed in a wooden box. This dark chamber is pierced by a circular hole of one third of a millimeter in diameter, through which pass the rays of light from the lens, those irradiations of the pencil of light which would blur the outlines of the photograph being arrested by the walls of the box.

As the reliefs of the image on the transmitting machine convey to the plate of the rheomicrometer a series of displacements varying in amount, the intensity of the current sent varies in proportion to the depressions and reliefs of the original proof. These electrical variations communicate to the mirror of the oscillograph movements proportionally rapid. Consequently the reflected luminous pencil oscillates from right to left, from the center to the edge of the lens: in its movements it encounters the different degrees of transparency of the scale of tints and thus has its intensity modified to a greater or lesser degree. When the pencil falls at the center of the lens it meets the transparent part of the chromatic scale and consequently the light transmitted suffers no weakening, and the effect is the production of a photographic black. On the contrary, if the reflected ray falls on the edge of the lens the complete opacity of the scale extinguishes the ray and the result in the picture is a white. For all the intermediate positions of the reflected ray, the scale of tints determines the amount of the modification, and the result is a photograph identical in tone with the one from which it is produced.—*Translated from Cosmos by J. H. Blakey.*

Incandescent Lamp as a Telephone

Without going into technical details concerning the connections, it may be stated that a 100 candlepower Osram lamp, burning on a 150 volt circuit, has been shunted into a telephone circuit in such a manner as to reproduce faintly speech which is transmitted to it from a microphone. The effect is attributed to the varying temperature of the filament, which sets the thin glass envelope in vibration. Lamps of 16 and thirty-two candlepower do not respond, as their glass envelopes are too thick.

Fleeing from Electricity

The spread of electric railways and electric light systems is driving magnetic observatories from the neighborhood of large towns and cities. The delicate instruments employed in such observatories lose their usefulness when extensive electric plants are in operation near them. An instance of this occurred not long ago when the magnetic observatory of Vienna was abandoned. The Austrian government felt that steps were necessary to provide a new observatory situated at a distance from the capital.

Tungsten Filmament Plays Trick

From the appearance of the picture, one not familiar with the sight of tungsten electric lamps might conclude that

AND YET THE LAMP BURNED

some aspiring rival of the wonderful Edison had been experimenting and placed within the globe a crudely constructed filament of complex design. Not so, however. The two prongs near the bottom, jutting downward to the right and left respectively, are not solid material at all. They are reflections. So is the one near the top on the right and also about half of the mass in the center.

But consider the one on the left near the center. That one is a white hot tungsten filament—part of the long zigzag glower in the center. This 40 watt lamp, while disconnected and hot, was dropped to a table. From there it dropped again to the floor and when reinserted in the socket caused surprise by glowing the same as ever. This alone was a wonderful enough stunt for a tungsten filament, but notice it again. In the hard fall the slender glower broke in two, but in some way the terminals became crossed and the filament was welded together again. Two dead ends through which current did not then have to flow may be seen hanging below the joint, and stranger still, the filament was hanging to the glass wall of the lamp, having become fastened there at the very point of welding, tiny as that was.

Electric Cross for Historic Church

The ancient and the modern are brought into striking contrast by the recent electric illumination of the cross which stands in the court of an old Spanish church in Los Angeles. This is probably the oldest remaining building in that city as it was built in 1812 at the time that Los Angeles was a collection of

ELECTRIC CROSS IN FRONT OF AN ANCIENT MISSION CHURCH

adobe huts straggling about the plaza. The historic edifice is the scene of many fiestas held by the Mexican parishioners, and on these occasions the cross in the churchyard shines forth.

An Elevated Railway for Trolley Cars

One of the latest additions to the rapid transit system of the Boston Elevated Railway Company is a new viaduct extension connecting the North Station with the Lechmere Square district in East Cambridge. The line was opened for travel last summer at a cost of about $3,500,000 and although it is less than a mile in length, it is one of the best equipped electric railway sections in the world. The new route saves about seven

GLIMPSE OF THE VIADUCT EXTENSION OF THE BOSTON ELEVATED RAILWAY

minutes on the average for each passenger entering the city of Boston over its rails. The tracks are laid upon a reinforced concrete structure, and are provided with both inside and outside guard rails for the entire distance. The movement of every car is governed by automatic block signals of the shielded lamp type, the signals being operated from a track circuit and by alternating current, so that they are independent of the direct return current used in the car service.

Perhaps the most interesting feature of the new line is a drawbridge located over the Charles River Basin outlet into Boston Harbor. At this point a concrete tower has been erected and switching apparatus provided with signal interlocking safeguarding the approach of cars to the draw. The latter is of the

THE FOLDING BUMPER

bascule type, built in two sections and it is raised and lowered by a 40 horsepower motor geared to each leaf, the control being effected by the tower operator.

In each track and about 50 feet away from the draw opening is located a folding bumper which is raised and lowered by a three horsepower motor controlled by the towerman. The bumper is built with a structural steel frame and provided with a red danger lamp operated by electricity.

Tools Hardened by Electricity

There is a process, of French invention, for hardening steel by means of an electric current traversing the red hot metal. Tools thus hardened are said to have given surprising results. A sharpened table knife cut one eighth inch iron wire as if it had been a string. Iron bars were easily cut with a circular saw. Drills pierced cast iron plates; and in all cases the tools showed no injury.

Utilizing the Power of the Columbia

At the present session of the Oregon legislature a bill was passed authorizing a committee of five from the House and Senate to investigate the possibilities of utilizing the power of Celilo Falls on the Columbia river, in accordance with plans prepared and submitted by State Engineer John H. Lewis.

If these falls are harnessed in accordance with the present plans the power generated will be 200,000 horsepower at the season of extreme low water and over 1,000,000 horsepower during a portion of the year. This would place this project among the largest of its kind in the world.

At the present time the money has not been appropriated for the carrying out of the project, as it will first require a thorough investigation and study of the conditions to be met from an engineering standpoint. This preliminary work will cost from $50,000 to $100,000. It is now under way and will no doubt be completed in time to submit the report to the next legislature in order to secure the appropriation necessary to complete the project.

The cost per horsepower per year is estimated at $9.00. It can readily be seen what a project of this magnitude will mean to the cities and manufacturing interests of the Northwest, especially in view of the fact that the project is to be carried out by the state of Oregon or the states of Oregon and Washington combined. This state supervision would insure the lowest possible cost to the power consumer and will no doubt go far toward placing these states in the front rank among manufacturing states of the west.

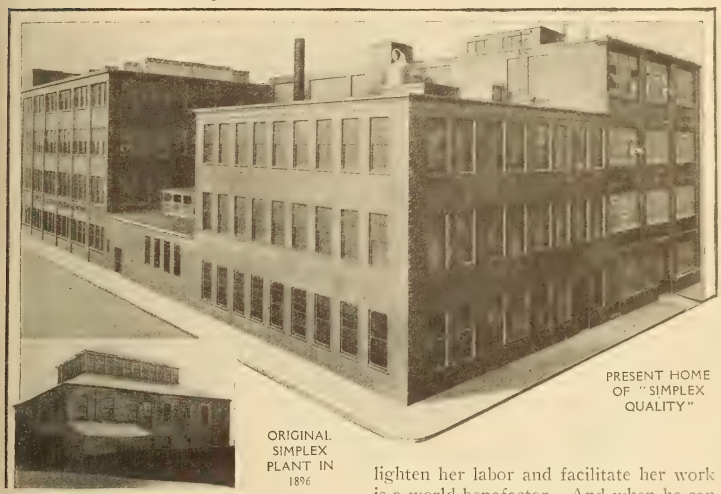
LOGGING BY ELECTRICITY

Progressive lumber concerns in the great Northwest have not been slow to realize the advantages of electricity as a motive power in their logging operations. The one great advantage over steam is the elimination of the fire risk; another is the actual cost of electric current which is lower in the west than in the east because of the development of the many waterfalls.

The illustration shows a train of fir logs being drawn by an electric locomotive to the saw mills some miles distant.

The Simplicity of Quality

By H. Bedford-Jones



PRESENT HOME OF "SIMPLEX QUALITY"

ORIGINAL SIMPLEX PLANT IN 1896

Every woman hates her domestic drudgery. But every woman is proud of her domestic drudgery, whether she does it well or not. She knows right well that nothing exists but for her, that all business is in the end operated for her, that every function of government and labor is exerted for her, the maker of the home. It is the woman who has no home to make who goes into business, but she never belongs there. She only stays there until she can make a home.

Business realizes this fact. Business men know its truth. Little by little the store is openly operated more and more for the maker of the home, less and less for anyone else. Most branches of our modern system of advertising are calculated to appeal to the home-maker. Every man who gives to the maker of the home some thing or things which will help to lighten her labor and facilitate her work is a world benefactor. And when he can combine this gift with the making of money he is a genius.

Such a man is James I. Ayer.

Eighteen years ago Mr. Ayer was a man with an idea. He lived in the Middle West, where ideas are born every year with the corn crop and die as regularly. But James Ayer had more than the mere idea. He had confidence in it, an absolute conviction of its worth to the world, and thorough belief in its worth to him. These things make for success, when combined with business ability.

Ayer had business ability to the nth power, and still has it in the same degree. He knew his business, which was electricity, as far as anyone knew it in those days and a good deal more than most people know it now. He was holding down an executive position, and his idea did not agree with it.

He gave up his position in the west and came east with his idea. He came to Cambridge, Mass., a town about as old as Boston and a whole lot prouder, and settled down to train his infant idea in the way in which it should go. It went.

Ayer got laughed at right and left on account of his idea. His enemies jibed at him and his friends pitied him, but he knew that his idea was right. That they could not see it was nothing against the idea; it was simply out of their range of vision. He had the right end of the glass, and they had a firm grip on the wrong end; the glass spelled business acumen. Today the others are fighting for a peep into Ayer's end.

His idea was that electricity could be used for heating. Others had tried it without success, but what of that? Everything else was in use as fuel, from natural gas to coal, and out in Illinois they burned corncobs and do yet.

"There's one objection to that," said friends and enemies alike. "That is the fact that electricity costs more than any other fuel."

At this James Ayer would look away and smile. The objection seemed perfectly valid. The only trouble was that the other fellows had the wrong end of the glass. It did not show them the water power of the West, and it did not show them straight business. But Ayer foresaw what actually happened; that just as soon as it was possible and to their advantage to do so, the electric companies would cut down the price. It was his job to make it to their advantage.

But to make the average housewife buy a product and keep buying it, that product must have two qualifications which will attract her. It must simplify her work and it must be reliable in the extreme. "Once bitten twice shy" is a favorite maxim of the homemaker and she observes it to the maximum. So James I. Ayer changed his name and began to write it "Simplex." When people asked what it meant, he replied "It means Quality." In order to be real aristocratic, he was soon writing it "Simplex-Quality."

"No, we'll lunch right in here," and Mr. Ayer opened a door from the show room, just off the main offices. There before me was a dining room, with a kitchen next door—both rooms fully as small as those of the average apartment. Yet the dining room accommodated six people and a good deal of tobacco smoke that noon, with ease.

In the kitchen was a cook, just drawing out a pie from an electric oven. Then I knew that I was to have an electrically cooked meal.

My friend showed me a basin and a nickeled tank above it. Pressing a button, a stream of hot water flowed in, all ready for the grit and grime of the shops.

"A little stunt of my own," he smiled. "Keeps enough water at any temperature desired to wash an office force. Handy, eh?—One ampere!"

I inspected that luncheon before it was eaten. Later, there wasn't enough left to inspect. Here in the kitchen was an electric range and oven, with other things all around them. The cook was not very busy, either; all she had to do was to turn switches and let the "lightning" do the work.

That luncheon was more like a dinner. A good share of it was made on the table, and we kept the toaster busy turning out evenly browned, flat and crisp toast which was a thrill to consume. A certain Boston restaurant installed a series of these toasters and inside of a month was renowned for its toast products. Folks come there from all over town for toast—when they could have the same thing at home. From roast to coffee, everything was delicate and delicious; nor had the cook expected company. I inquired why the Simplex inventions were not more widely advertised.

"No use," came the smiling reply. "We're advertised by one thing—Quality. Everything that goes out of the shops is an advertisement.

THE UPPER ILLUSTRATION SHOWS ONE OF THE ASSEMBLING ROOMS WHERE THE ELECTRIC COOKING UTENSILS BEGIN TO TAKE DEFINITE FORM. BELOW IS SHOWN THE PROCESS OF WINDING AND FORMING THE HEATING UNITS

THE ENAMELING PROCESS IS HIGHLY INTERESTING

A GIGANTIC BAKE OVEN SUITABLE FOR THE REQUIREMENTS OF A BATTLESHIP

"We are simply following out a basic principle of good business—that quality is essential to continued sales. Right now we're getting ready to occupy the new building, and we can't fill the orders. Of course, we do advertise to a certain extent, but we can't keep up. Want to see how the iron is made?"

The various portions of the iron are first received from the foundry to be cleaned. The foundation of the Simplex goods is the direct contact established between heat producer and heat consumer. In the iron, as in other products, this is effected by enamel.

The face, or base, of the iron is a hollow, boat like cast. In this is poured enamel, six layers to it. Then the iron base goes to the wiring room to be wired —and here steps in Quality.

When received, the wire is examined

under the miscroscope for any defects; it receives, in all, eight such inspections. Then it is crimped into a continuous S shape. It is then inspected for resistance, shaped to the figure of the iron and flattened. When immersed in the enamel, this wire forms a continuous network reaching all over the base of the iron. Larger wire terminals are left out, the rest being overlaid with more enamel.

The enameling process is highly interesting, too. After each of the nine layers is put on it must be dried and baked in the furnaces and then tested. All this work is done by hand; all the work of shaping and immersing the wires is done by hand; and I suggested that machines could do it as well and a good deal more quickly.

"They might," was admitted after some argument. "But on the whole hand work is more satisfactory. Then we know it's right. The whole network of wires must touch at no point or the whole affair is ruined. The enamel might all be put on at once, too, but the quality would be a good deal different."

So here were working crews of girls, women, men and boys, sending wires down the line, each shaping or bending or testing some piece until it was ready for immersion. When the wires were covered the iron, or range plate or heater, as the case might be, was inspected and tested thoroughly for insulation and resistance, and went on to the assembling room. Here the top of the iron was added.

Between the top and bottom pieces of the iron is an air space. This keeps the top of the iron cool, air being a non-conductor of heat. For the same reason, the range heaters, coffee percolaters, toasters and other devices are all equipped with a lock or clamping device, which is most important. Suppose an ordinary cooking utensil were placed upon one of the heating disks of the stove. Had the utensil any bumps or dents in its bottom, as ordinary ones have, a pint of water would take a long time in coming to a boil because of the air interposition. When the flat bottomed vessel is clamped to the disk the water will boil in less than twelve minutes.

The cost of running electric cooking devices for an average family is between four and five dollars a month. This is what James I. Ayer has done for the housewife. He knew well enough that when people began to use electricity for heating, the electric companies would give special heating rates, as they now do in many cases. Out west and in Japan, where water power predominates, the demand for these devices is more than surprising. But the real saving is in the more indirect ways.

"Most people figure on direct savings," declared Mr. Ayer. "I'm just teaching them to figure on indirect saving. Often they teach me, though. For instance, we sold a line of waffle irons to the Harvard Union here. Some time after I discovered by accident that they were making an immense saving on material. It surprised me. I found that they did not have to grease the irons, which saved butter. Then the irons required only 25 per cent of the attention needed by the old ones, which saved labor. By heating the dough on each side at once, and more evenly, much less dough was needed because the waffles came out lighter and better cooked. Then we began figuring on shrinkage in everything.

"For example, our bread ovens, which are used in large institutions as well as in private homes, and our regular ovens for general cooking. With gas or other fuel there is a passage of fumes and air through the oven which shrinks meat and other foods in a large percentage. This is eliminated here."

The test of efficiency in the modern housewife; are we master of our own comfort or is it master of us? If the average home-maker could go through the Simplex factory she would not be afraid of this test. Here were immense coil heaters for heating water, together with attachments for ordinary boilers which would maintain an even tempera

ture. Here in one room I saw the heating pads being stitched and wired—everything arranged for three heats under absolute control.

The factories themselves are indicative of their famous watchword. Here I had come half across the continent to find them, and yet none of the Cambridge folk could tell me their location! Finally I saw them—a group of rough finished concrete buildings four stories high, illustrative of every style of concrete structure from the earliest solid-block wall to the addition under construction, with glass and steel walls. Inside was none of the terrific magnitude of other great electrical centers; each worker was going steadily ahead, not rushing to fill orders but plodding away steadily and surely, working for quality and not for quantity. Here there were no secret processes to avoid, all was honest New England workmanship, simplicity and quality throughout.

What a change from the New England workmanship of a century since—from the wooden nutmeg to the Simplex iron! As you go through these factories and watch the assembly workers putting together electric ovens, coils, stoves, coffee pots, dining room table stoves, curling iron heaters, and numberless other devices, you realize that life is being transmuted for the modern housewife from drudgery to a series of thrills unparalleled. Then there are the radiators and their kindred air heating cousins, made for every purpose and kind of room. A modern housewife can be an artist, no less! Automatic, perhaps, but none the less an artist, for her work will be done artistically. The pad heater, for example, which takes the place of the old hot water bag, is controlled by two thermostats, which automatically prevent the heat becoming too great; the coffee percolator contains an automatic safety device which prevents it "going dry," and makes it foolproof. Only artistic things are foolproof.

KITCHEN IN THE SIMPLEX FACTORY USED PURELY FOR EXPERIMENTAL PURPOSES

A noteworthy thing in these shops is their readiness to turn out work which

is special. In one corner was a gigantic bake oven, a special order for a battleship. Here in another room was a matrix heating table for a large city newspaper office—a device which will greatly facilitate special and "late" editions, since the matrices are thus dried at an extremely rapid rate.

But let it not be supposed that Mr. Ayer confines his activities to the home and the kitchen. Far from it! The factory applications of these heating machines are many, from soldering irons to paraffin kettles, and here they were all in process of manufacture. In one department were copper workers, turning out hand worked copper utensils of singular beauty. In the oven department I saw ovens adapted to various drying uses—lacquer and other things—while the laundry machinery has worked a tremendous saving in laundry equipment and work.

Another point in favor of the large baking oven for hotels and the like, besides the 75 per cent saving in space or floor room and the large saving in labor, is the absolute uniformity of the product and the cleanliness of the cooking. There is no gas vapor or soot to be cleaned out lest the loaves be dirtied, while the aluminum finish on the interior of the ovens remains bright for years. The result is that the products absorb none of the flavors which make an almost imperceptible and yet large difference in the end.

As I was writing this I happened to see a report of a gathering of hotel chefs, in which it was stated authoritatively that the usual allowance for shrinkage in a 40 pound roast was eight pounds. This, of course, in the average old style ovens. With the electric oven this would doubtless be reduced to almost nothing—which fact would annihilate the argument of high cost of power.

And for general purposes of heating, electricity bids fair to be the cheapest fuel. The price of other fuel tends steadily to rise, that of the electric current to lower, as improvements are made in generating and distributing it. In Chicago the rate for electric baking to a bakery with a capacity of 10,000 loaves a day is 1½ cents per kilowatt-hour—about one cent or less for each twelve loaves. In a larger plant, with a 50,000 loaf capacity, the rate would be one cent per kilowatt-hour. Where water power is available, current can be had at still lower rates, and its cost is going down steadily all the time.

And all this is the simplicity of quality—the highest and yet the simplest thing in all our civilization. All this electric heating business is coming into its own before long, when the people of the world shall have wakened to its possibilities. And the wakening is due to my friend, James I. Ayer!

Vaporized Quartz

A beautiful opalescence may sometimes be observed in the glass globes used to diffuse the light of the electric arc, particularly after such globes have been in use for a long time.

Close examination shows that the opalescent effect is due to the presence on the glass of minute spheres of silica which have evidently been formed by volatilization from the glass under the influence of the electric arc. This effect is in accordance with the experiments of French scientists whose electric furnaces have produced some surprising results.

The essential feature of the furnace is an electric arc of great intensity. When rock crystal, broken into fragments, is placed in the furnace it simply melts, like so much ice, and in a few minutes the liquid thus formed begins to boil.

The vapor rising from the liquefied crystal is condensed into a little bluish white cloud, from which tiny spheres of silica, glimmering with opalescent hues, are deposited. These spheres, as already remarked, are similar to those found on arc light globes. The latter, of course, are the product of a very slow and gradual process, while in the electric furnace the volatilization is effected with rapidity.

Harnessing the Nile

The engineers who have been at work on the problem of transmitting electric power from the cataracts of the Nile, continue to picture the results obtainable in glowing colors. One states that the city of Cairo can be lighted cheaper by power generated at the First Cataract, over 400 miles away, than by means of steam engines situated in the city itself. By a system of irrigation, combined with electric power from the cataracts, he avers, the Dongola province, up to the Fourth Cataract, may be made the most fertile country in the world.

White Lines to Protect Life

Two electric railway companies of a western locality have lately adopted an innovation for the protection of passengers and others, extremely simple and effective. It consists of a white line about six inches wide painted or whitewashed on the ground a distance of about twelve inches from the path followed by the extreme point of any projection on the passing trains or cars. Persons adjacent to the tracks instinctively notice these conspicuous marks and as a result casualties are fewer, particularly at curves where the forward and rear ends swing out over a greater distance than the remaining parts of the cars. It is this last "gymnastic" action on the part of moving cars that has caused many an unexpected "bump."

Giant Electric Crane

The Fore River Shipbuilding Company, at Quincy, Massachusetts, is using in its work of building battleships and other war craft, a giant electric gantry or crane. This crane was originally designed for a maximum capacity of 75 long tons. Finding this to be insufficient for the great weights introduced with the building of turbines, this was increased to 100 tons, which weight it will carry out for a distance of 50 feet from the side of the wharf and 30 tons from there out to the end of the arm, 85 feet from the side of the wharf.

With the arm raised the end towers eight or ten feet above the 225 foot fire control masts of the battleship *Rivadavia*, now being fitted for her trials in March.

ELECTRIC CRANE AT THE FORE RIVER SHIPYARD

Magnet Bill

He does not look like a very important part of a big automobile factory organization, this tall, broad shouldered man who may be seen, rain or shine, summer and winter, walking slowly about the

MAGNET BILL AT WORK

plant of a motor car company, Toledo, Ohio. His eyes are almost constantly cast earthward. And he saves the company thousands of dollars in a year.

"Magnet Bill," as he is called, gets his nickname from the fact that his tools consist solely of one tin bucket of the ten or twelve quart variety and a big steel magnet strapped to the end of a shovel handle. His work is to save automobile tires, those costly rubber overcoats which adorn the wheels of motor cars, by removing from the roadway every nail and bit of iron, brass or steel that might cause a puncture. When it is known that 40,000 cars, which is the output of the factory for 1913, will be run back and forth in reaching places where they are tested and that scores of visitors' cars, office machines and delivery trucks use the roadways daily, the importance of Bill's job is at once apparent.

Safety Switches on Old Seventeen Mile Grade

Along the headwaters of the Potomac River, high up in the Allegheny Mountains, winding and twisting its way tortuously down the steep sides, is one of the steepest and longest railroad grades to be found east of the Rocky Mountains.

Here every year railroad men have been killed and in winter time especially, for every train that descends this grade must have hand brakes set in addition to the air brakes, for once the train gets started air alone will not stop it.

This is the old "seventeen mile grade" of the Baltimore and Ohio Railroad, the bug-ga-boo of all eastern railroad men. It starts at Altamont, Maryland, and drops at the rate of from 73 to 124 feet to the mile till it terminates at Piedmont, West Virginia, seventeen miles below. This grade is on a very important division, too, as it taps the West Virginia coal regions and connects with Chicago via Chicago Junction.

Trains often get beyond the control of the engineman and brakemen and rush down the grade at a terrific speed, wrecking themselves against the first obstacle.

It is for the purpose of catching and safely stopping these trains that electric safety switches have been installed—one five and the other ten miles from the top. Side tracks at each point lead directly from the eastbound main track and run parallel with it for a distance of 4,500 feet, but unlike the other track they rise, starting with a three per cent and gradually they assume a 24 per cent grade, sufficient to stop a train traveling at a speed as great as 120 or 125 miles an hour.

The switch to each side track is connected to an electric release in such a manner that a train going more than fifteen miles an hour will be headed in this track and stopped before it has time to do any damage.

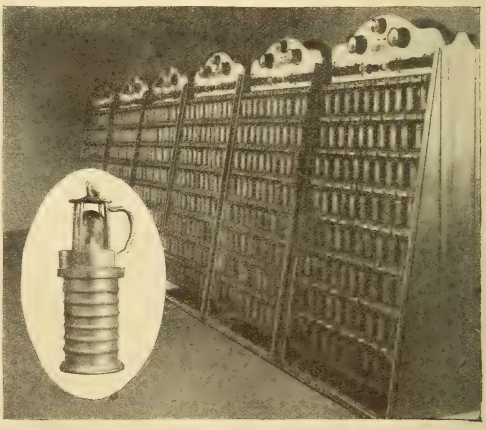
Instructor's Variable Resistance Unit

In teaching students the use of electrical measuring instruments, a resistance that may be varied is very often needed with its ohmic value known to the instructor and unknown to the student.

A handy way of arranging such a device that is capable of being easily and quickly changed is as follows: Use an ordinary plug resistance box with indicated values. Enclose this in a box just large enough to contain it and attach binding posts at a convenient outside point, with wires leading to the binding posts on the resistance box. The resistance should be accessible to the instructor who can change the combination at will by withdrawing certain plugs, unknown to the student. This device will effectually prevent "copying" and is much more accurate than the ordinary calibrated coil.—V. E. Miller.

German Miners' Electric Lamp

This German prize miners' electric safety lamp will not ignite inflammable gases, a most important requirement. The two volt lamp gives 1½ candlepower and will burn steadily for sixteen hours on the storage battery used. The steady light which the lamp affords protects the miner from nystagmus, an involuntary, rapid twitching of the eyeballs often brought on by the ordinary flickering torch. The light is switched on and off by simply turning the top of the lamp, all other contacts being dispensed with. The large picture shows an equipment for charging 80 of the lamp batteries in a series of racks.



GERMAN MINERS' LAMP AND BATTERY CHARGING RACK

Flickerless Moving Pictures

In looking at a moving picture every one is aware of a perceptible flicker and the most modern machines have never done away with it entirely. The cause of this flicker is in the shutter of the projecting machine. Each individual picture on the long film is brought before the lens of the arc lamp. It is exposed for a fraction of a second, the revolving shutter shuts off the ray of light, another picture is brought forward during the instant of darkness, and the light is turned on again. As these individual exposures occur at the rate of about sixteen per second we see practically a continuous picture on the screen, but just the same there are sixteen periods of darkness in every second which cause the objectionable flicker.

To eliminate this flicker has been the dream of inventors. Theoretically it can never be done, for this is attempting to reproduce a moving train of separate and *slightly different* pictures as a single continuous picture. Practically, however, the result may some time be so nearly attained that the eye cannot perceive the

blending of one picture into another—which is all that is necessary.

The vanoscope is a new moving picture projecting machine, so entirely different in principle from other machines and so promising in the results obtained from the first crude machine built, that it is hoped that with further refinements it will produce a flickerless picture, at least as far as the eye can perceive.

The machine has no shutter—there is no period of darkness. So far it is promising.

The film, the ordinary kind, travels horizontally. The arc lamp lens is above the film and the ray of light is projected down vertically through the film. Below the film is a mirror so set as to project the beam of light out horizontally to the screen.

Imagine, now, a single picture moving through the beam of light. The picture is caught by the mirror and thrown on the screen.

"But," you say, "in that case the image would travel down across the screen as a blur."

True enough, it would, if the mirror remained stationary. But it does not. It rocks. This rocking motion is regulated so accurately that it just corrects for the forward motion of the film and the image of the particular picture we are considering remains stationary for an instant on the screen. If some one were carrying a candle by in front of you and you were attempting, with a mirror, to throw the image of the flame at one point on a large mirror or screen in front of you, you would have to move the mirror in your hand a very little as the candle passed by. In this new projector the principle is the same.

Another question now immediately arises. "This is but a single picture on the film. How about the next one following right behind it? Does the mirror jump back to pick up this new image? In that case there would be the same period of darkness as with a shutter."

The answer is that there is more than one mirror. They are mounted on a revolving shaft—at a slight angle that gives the rocking motion. As one picture passes through the beam of light it is taken up by one of the mirrors and thrown onto the screen. Passing through, it begins to fade but immediately behind it comes the next picture, which is taken up by the following mirror and begins to come on the screen as the preceding one begins to grow dim.

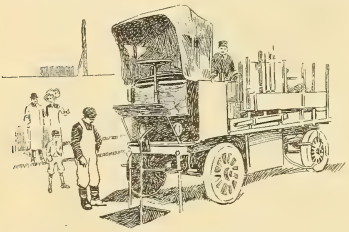
To carry our analogy further, suppose four persons with hand mirrors stand in a circle facing outward. Now suppose a line of several hundred people carrying candles, all held at the same height, to be passing by at uniform speed on one side of the circle. In the background is a large mirror or screen. Now let the circle of mirror holders begin to revolve. The first member of the circle catches the image of the first candle and projects it at one point on the screen just as long as he can by rocking his mirror. But he finally passes out of range. But long before this the second member of the circle has caught the image of the second candle and projected it on top of the first image—and so on around. If the members of the circle could move just fast enough and manipulate their mirrors with mechanical exactness a continuous image of a candle flame could be kept on the screen.

In other words it is a dissolving effect, only this dissolving is done so rapidly—say about eight times per second, that the blending of one picture into another is scarcely perceptible. When the machine is perfected it is expected that the change from one picture to another will be imperceptible to the eye and that the resulting picture will be flickerless.

There are in addition certain other advantages claimed for the new machine. The light when it strikes the film is cold and cannot ignite the film if the latter stops. A saving in electric current is also claimed. The film travels more slowly, giving a more natural speed to moving objects in the picture.

Electric Truck as a Moving Power Plant

Almost every day, industry is discovering new ways to make use of the sustained energy of a storage battery in connection with truck transportation.



TRUCK MOTORS USED IN CABLE PULLING

For example, concerns have converted it into a portable power station which, when not engaged in propelling heavy vehicles, is used as a plant for hoisting, or for cable service work as shown in the illustration.

Telephone Dispatching on the Canadian Pacific

With the exception of a small strip between Winnipeg and Port Arthur, train dispatching by telegraph has been totally abolished on the Canadian Pacific Railway of Canada. This mammoth system that operates 16,000 miles of first class equipment, and incidentally owns 75 steamships and eighteen big hotels, cast aside the last telegraph instrument used for dispatching on its single track lines during the first week of January, 1913, when telephone wires linked up Vancouver and North Bend. Between the Pacific Coast and St. John, New Brunswick, with the one break for 400 miles of double track at Winnipeg, the manipulation of rolling stock is by voice and not by the Morse code.

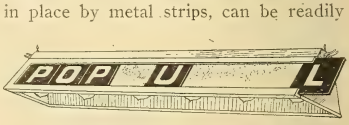
When the first experimental station between Montreal and Farnham, Quebec, a distance of 60 miles, was installed six years ago, a test then made showed that an operator could dispatch 86 trains in eight hours. Messages were sent to three offices and repeated back. That meant that a train was dispatched on an average of every five and a half minutes during the whole of the time. The man in charge of the initial experiment was Mr. J. F. Richardson, now superintendent of C. P. R. telegraphs at Vancouver.

Such work, the railway chiefs claimed, was a physical impossibility for the telegraph or its operator. It meant, too, a great economy over the entire line in the delays obviated. To make the change involved enormous expense, two extra heavy copper wires being required over every inch of the 16,000 miles of trackage. On the section between North Bend and Vancouver copper wire weighing 210 pounds to the mile was strung—quite an unusual specification in telephone work.

The chief reason back of the change from the telegraph dispatch system is that the telephone is vastly less liable to make mistakes, and that one train wreck involves a railway in more expense than would meet the cost of scores of miles of modern telephone construction.

Combined Window Sign and Reflector

A window reflector that serves at the same time as an illuminated sign is here illustrated. The letters, which are held in place by metal strips, can be readily



WINDOW SIGN AND REFLECTOR

changed about to make the sign call attention to sales, special offers, etc. The sign is made up in sizes to suit any window and is held in place by chain suspensions.

Lightning Discharges from Kites

A number of very violent lightning discharges down the wires with which scientific kites are flown have been recorded. In some cases the flash coming down the wire burned and destroyed several thousand feet of wire. One observer says that a column of fire a foot in diameter seemed to follow the wire. The slight electrical disturbance conducted down Franklin's wet kitestring, was trivial compared to these most dangerous discharges.

Ventriloquism and the Loud Speaking Telephone

At a recent luncheon of the Chicago Electric Club this odd looking figure perched upon the stool demonstrated that

ANYONE WHO CAN OVERCOME STAGE FRIGHT MAY BECOME AN EXPERT VENTRILOQUIST

anyone who can overcome stage fright may become an expert ventriloquist.

Within the dummy was carefully concealed a loud speaking telephone which was connected to a transmitter behind the scenes by wires running down the legs of the stool to the floor.

The dummy, which was introduced by President A. A. Gray as "the mysterious electrified ginkerino," talked, sang, whistled and moved its head, arms and jaws in a manner fitting replies to the interlocutor's questions. The "ginkerino" was made under the direction of Mr. A. S. Hibbard of the American Telegraph and Telephone Company of New York City, and is fondly called by him a "figure of speech."

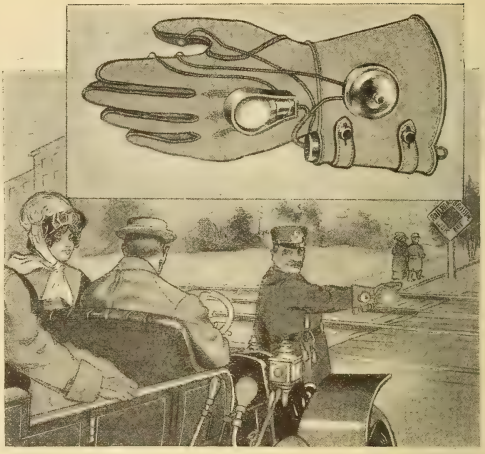
Magnetic Attraction and the Compass

It is curious how the scientific realities of to-day often bring back to one's mind the memory of some half-forgotten fairy tale. We can most of us call to mind the story of the ship which approached too near the enchanted island, with the result that the lodestone rocks drew from the vessel's timbers all the nails and bolts and it became a total wreck.

A terribly real story of a wreck is that of the Danish steamer "Norge," which, some time ago, strayed from its reckoning and struck on the island of Rockall, with a loss of many lives.

A scientist, in discussing this wreck, asked the question, "Can the compasses of modern ships be influenced by magnetic disturbances to such a degree as to imperil navigation?" He assumed that the "Norge" should have been quite 25 miles to the south of Rockall when she struck. He believed that the difference in position must have been due to some deviation of the compass brought about by a local cause, and he cited the depositions made by two captains of other vessels in corroboration of that view. In one case, when in the neighborhood of Rockall, the ship's compasses acquired a hitherto unknown easterly deviation of ten to eleven degrees. In the other case the compass of the ship also in proximity to Rockall—deviated nine degrees, and while the captain was steering to pass 20 miles north of the island he found that the actual path covered was 45 miles north of it.

Audible and Visible Signal



The crossing policeman, the chauffeur, and the driver of the horse drawn vehicle—all will find use for the bell and lamp signal patented by Charles A. Schindler, West Hoboken, New Jersey.

The outfit, consisting of a bell, lamp and battery, is secured to a specially made glove. Up in the first finger of the glove are two contacts and upon the thumb, one. By bringing the thumb contact against either one or the other of the finger contacts either the bell may be rung or the lamp lighted according as an audible or visible signal is desired.

Odd Current Collectors on Italian Cars

To call them cumbersome would be putting it mild, in expressing oneself concerning the current collecting devices on these Italian cars. They are almost as cumbersome as the name of the line on which they operate—the Tramvie Elettrische Roma-Civita-Castellana.

Tension on the Surface of Charged Conductors

If two soap bubbles are blown, one at each end of a glass tube, the smaller one grows smaller at an increasing rate, if both are unelectrified. If now the smaller one is electrified, the effect is reversed,

INTERURBAN ELECTRIC CARS IN ITALY

the larger unelectrified bubble becoming smaller. This simple experiment has been quoted by a member of the Cambridge Philosophical Society as proving that the electrification of a conductor results in the creation of a mechanical tension over its surface.

Dr. Bergonie's Apparatus

Much has been written recently of the work of Dr. Bergonie of the Institute of Bordeaux in regard to the results he has obtained with high frequency current. In the March issue of this magazine appeared an interview with the celebrated physician in which he corrects many false notions that have become prevalent concerning his methods and the results obtained, and tells exactly what he has been able to do. In view of all this, it is interesting to see the apparatus itself and the photograph here reproduced is of the Doctor's own equipment as he uses it in Bordeaux, France.

The apparatus consists of a high frequency coil or resonator made in the form of an old fashioned hoop skirt and suspended from the ceiling. The current, brought from an outside feed wire, passes through a suitable transformer. On the table is placed the governing apparatus. A control switch and a dial indicate the intensity of the current, which is easily regulated by the slightest movement of the switch handle. The top of the table is of marble to facilitate insulation. Two wires lead to the patient's body and the circuit for the high frequency current is completed by two contacts strapped to the bare flesh of the leg or such part as it may be specially desired to treat. The current may be regulated to two or three amperes with a difference in potential of several thousand volts but without any uncomfortable sensation; this by the high frequency of the alternations.

DR. BERGONIE OF BORDEAUX EXPERIMENTING WITH HIS HIGH FREQUENCY APPARATUS

Semi-Indirect Units

As a result of the present day tendency in illumination installation design to employ some type of fixture which completely conceals the glaring light source, a wide field has been opened for the design of shallow bowls and plaques known as semi-indirect units. Such lighting

SEMI-INDIRECT UNIT

units are so named because the electric bulbs are completely concealed from view and a certain portion of the light is transmitted directly through the translucent glass of which the bowl is made in a very soft, diffused form, while the remainder of the light, owing to the high polish of the interior surface of the bowl, is reflected to the ceiling, which in turn redirects the light, also in a diffused form, down onto the workng plane.

These bowls are made in designs characteristic of the art designs of the different historic periods, so as to harmonize with the architecture of the buildings in which they are used. The accompanying illustration shows a Renaissance design semi-indirect unit, 20 inches in diameter, in Lucida glass, which displays the features of art design in the Fifteenth and Sixteenth Centuries and is unique in it's elaborate and intricate character.

The cast iron molds from which these bowls are pressed are engraved by hand and cost hundreds of dollars.

Electricity Used in Dyeing Cloth

Among the tasks now imposed upon that busy servant of man, electricity, is the acting as an assistant in the operation of dyeing. When cloth soaked in aniline sulphate is placed between two metal plates connected with the opposite ends of a dynamo and an electric current is passed through it, the sulphate is converted into aniline black. By altering the strength of the solution and of the current, shades varying from green to pure black can be obtained. In the case of indigo, the cloth is impregnated with a paste of indigo blue and caustic alkali. The electric current converts the insoluble indigo blue, by reduction of oxygen, into indigo white which is soluble and on being exposed to the air becomes oxidized once more and turns blue, thus thoroughly dyeing the cloth with that color.

Street Car Held to be "Vehicle"

In a majority opinion handed down recently the Massachusetts Supreme Court, in the case of J. Sidney Foster against Thomas P. Curtis, held that an electric car is a vehicle in the meaning "of the law of the road" and the driver of an automobile or other vehicle going in the same direction as a car must turn to the left. Chief Justice Rugg and Justices Loring and Hammond dissented, holding that the electric car is not a vehicle.

The Crookedest, Costliest Roulette Wheel

By FRANK PARKER STOCKBRIDGE

This is the true story of the crookedest, costliest roulette wheel in the world, and it was operated by electricity. In fact, it is the story of two of them. One still exists and may be seen by anyone who has the entrée to the beautiful New York mansion of one of America's steel magnates, a mute witness to the fact that the game of roulette may be not only the crookedest game in the world, but that its fraud may be developed to such a degree of refinement that the player could not win a single bet against the dealer's wishes, even though he might play away the combined fortunes of all the millionaires on earth. The other wheel, mate to this one, has been destroyed and I had a hand in its destruction.

One day, in the early autumn of 1907 there came to the city editor of one of the New York dailies the story of a big gambling enterprise that was being conducted in a modest little cottage near Cedarhurst in Nassau County, Long Island. I was called upon to investigate. Going to Mineola, the county seat, I discovered a somewhat singular condition of affairs. Stories were being told of the astonishing sums of money lost by the wealthy residents and that great mystery seemed to be thrown around the details of a raid that had been made upon the little "Inwood Cottage," when a roulette wheel and other gambling devices were seized by the sheriff. All about the courthouse at Mineola men looked strangely wise and said little whenever questioned about the raid. Especially were they close-mouthed concerning the mysterious roulette wheel and what had become of it.

Briefly, the story was, that early in the summer a pleasant featured, ministerial man had appeared at Cedarhurst looking for a summer cottage. He was known as Mr. J. Martin. After much investigation, he took the Inwood Cottage, on the ouskirts of the village and shortly after the lights first appeared in the windows of the new neighbor's house there began to float about the neighborhood stories of interesting doings. The neighbors gossiped and watched and finally somebody put pressure on the sheriff and the raid followed. Still there was mystery, for Martin, the proprietor, escaped, and nobody knew what had become of the roulette wheel, about the peculiar actions of which there had been a great deal of talk.

The sheriff, with more or less reluctance, allowed me to go down into the basement of the courthouse and examine several roulette wheels that had been taken in various raids in that country. But the wheels I saw there were ordinary ones and evidently the instrument of crookedness that had been described by some of the men who had paid tribute to its ingenious mechanism, was not among them. From reliable sources that night I obtained a more detailed description of the electric wheel and returned to Mineola with the determinaton to find it.

On my second visit I fell in with a kindly disposed under-sheriff who, quite innocently, as I believe, opened the way for the final discovery. At first he led me down into the basement where I had seen the other wheels.

"Are you sure," I asked him, "that these are all the roulette wheels in the custody of the sheriff?"

"Oh, no," he answered. "There is another one stored in there," and he pointed to a door opening into another part of the courthouse basement. Only a glance at it was required to convince one of its superior order. It was exquisitely fashioned and finished and everything about it showed the superior skill of its builder. A crowbar, chisel,

THE ROULETTE WHEEL USED AS EVIDENCE IN COURT TO SHOW THE PRINCIPLE OF THE DEVICE AND METHOD OF PLAY. THIS ONE DIFFERS FROM THE CROOKED WHEEL IN THAT IT IS A DOUBLE ENDED AFFAIR HAVING TWO TABLES FOR PLAYERS

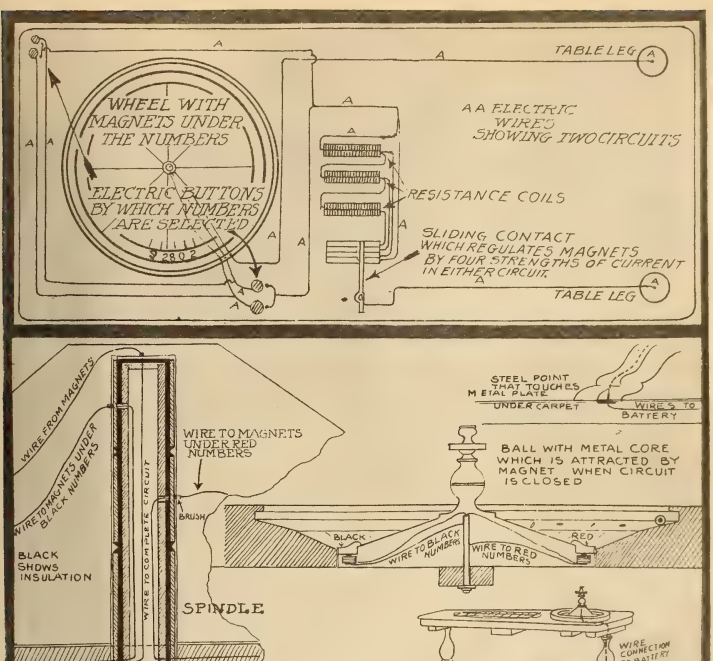
screw driver and other tools were obtained and the work of dissection began.

The cash drawer was the point where our examination began and immediately that was drawn out, the key to the mysterious working of the wheel was dis closed. Projecting from the under side of the table, where they could not be seen when the drawer was closed, were three tiny knobs within easy reach of the dealer's fingers. Steel dowels prevented the drawer from being carelessly removed.

Our next move was to remove the cloth from the top of the table, and there we found, in puttied concealment, resist ance coils and switches for controlling the current. Under the cloth and soft blanket were two metal disks. These were set flush with the top of the table and directly in front of the dealer's position. Until one of the knobs under the table was slightly rotated, these disks remained immovable, so that one might pass his hand over them and never discover their presence. The disks were a trifle larger than the chips or counters ordinarily used in gambling and were located at a point on the table where the dealer could place a stack of chips upon them without attracting the slightest attention. The least pressure was sufficient to depress the disks.

We next discovered that each disk operated a switch by which the main circuit that formed the basis of the device was connected. Buried also in the wood top of the table were three German silver resistance coils, so insulated and packed as to indicate that they were intended for use with currents of comparatively high potential, such as that used in incandescent lighting. These coils connected with three copper bars across which traveled a contact point actuated by the second of the three knobs in the drawer.

When contact was made with one of the bars the current traveled through a



LAYOUT AND CONNECTIONS OF THE CROOKED ROULETTE WHEEL

single coil on its way to the magnets, thus reducing its energy appreciably. Contact with another bar sent the current through two of the coils, reducing it still more. The third bar sent the current through all of the coils, while the contact of the same switch with a fourth bar gave the full normal strength of the current. The switch could be placed instantly in any one of the four positions by a single move of the dealer's fingers, making it possible to throw the current into any one of the four sets of magnets, each wound for a different strength of current. Both main circuits were connected with the resistance coils, so that eight different combinations could be made, each affecting a certain group of numbers on the wheel.

In operation, therefore, it would be possible for the dealer to set the magnets for either black or red, high or low, odd or even, making certain that the ball would roll into the desired group. Switches for black, odd and high—29, 31, 33 and 35—eliminated all chance of winning on any other combination outside of that. If the switches were so manip-

ulated as to throw the ball into black, odd and low—11, 13, 15 and 17—all other bets were lost. It was the same with black, even and high—20, 22, 24, 26 and 28.

Even the bolts and screws were made to transmit current, and we found that one screw that held on a cleat under the extreme end of the table was loose and could be slightly rotated. This was near the wheel and in manipulating this screw we discovered that two slight depressions could be felt under the cloth. Ripping off the cloth at this point we found two more disks, smaller than the others and discovered that they also operated the two main circuits. It was readily seen that the purpose of these extra disks was to enable a confederate to stand carelessly at that point and operate the screw in case the dealer chanced to have no chips in front of him to place on the other two disks.

Each leg of the table carried a wire which by means of plates under the carpet was easily connected with the electric lighting current. These wires were not revealed, even when the bolts holding the legs in place were unscrewed, for each nut was a terminal into which one of the four main wires was soldered and the bolt itself made a contact with the wire that projected ever so slightly into the hole in the leg. For carrying the current to the wheel the table circuits ended in three minute pin points, barely projecting through the cloth, where they were covered when the circular frame of the wheel was in place. Plates on the frame completed the contacts, and wires run through the wood to the contact pin, on which the wheel revolved, which was laminated and the sections carefully insulated from each other by mica strips. Connection with the revolving wheel was made by means of tiny copper brushes set up in the cavity into which the pin slips when the wheel is in position. The wheel could be taken off and closely examined without their presence being revealed and any spark such as might come from brush contact was so hidden that its light would never give the device away.

The magnets were concealed inside the wheel itself, with only a thin veneer between them and the rolling ball. The ball, while of ivory, had a soft iron pin through its center, the ends being almost invisible because they coincided with the lathe centers.

The manipulation of the wheel was simple. Roulette is played by spinning the cup like wheel, while the ball is thrown so as to travel around its rim in the opposite direction. The ball drops eventually into one of the numbered pockets of the wheel and that is the winning number. The players place the money or chips representing their bets on the numbered spaces on the table and all bets on the number into which the ball drops win and the others lose.

A winning bet on a single number pays the player 35 for 1; on the line between two numbers, 17 for 1; on a group of three numbers, 11 for 1; on one of the three columns or on the combinations 1 to 12, 13 to 24 or 25 to 36, two for one; on red or black, odd or even, or high or low, one for one. All players except those who have bet on the 0 or the 00 lose when the ball drops into either of those spaces.

By noting the preponderance of bets on the table, the dealer could switch the current on this electric wheel so that the ball would be drawn by magnetic attraction into the section of the wheel containing the numbers on which the smallest amount of money had been staked, and in the course of time the "house" was sure to win everything the players were willing to risk.

Publication of the details of the finding of this remarkable machine occasioned a decided stir among the gambling fraternity on both sides of the Atlantic. It established once and for all that electricity could be so employed as to enable a roulette wheel to win every dollar placed on the table. It also brought to light the fact that these two remarkable wheels—

the one described and its mate in Atlantic City—had robbed their patrons of many hundreds of thousands of dollars. Following the exposure came a series of court proceedings by which effort was made again to gain possession of the device. Although the deputy sheriff with his crowbar and screw driver had mutilated the apparatus in pretty bad shape, what remained of it was still regarded sufficiently valuable to fight over in the courts, but so far as I know it was never restored to its original owners and was finally destroyed by the officials of Nassau County, in accordance with the law.

But some very interesting things did develop in connection with the other wheel in Atlantic City. That is the one that my millionaire friend in New York has among his bric-a-brac, and he paid a high price for it. How much of his great wealth its magnets had attracted from him I do not know, but at the time the disclosures were made at Mineola the proprietors of the Atlantic City wheel held his "I O U" for the little matter of $125,000. It had so happened that one night when he left his check book at home, he had plunged pretty heavily in the hope of beating the wheel, and before he got around to settle the matter the proprietors of the gambling place had fallen out and were having a bitter quarrel which involved the share that each was to have in the millionaire's little account of $125,000. The man who had made the two electric wheels in Minneapolis and brought them East was to have received one third of all the winnings on the Atlantic City wheel, which he still owned. The proprietor of the house refused to make good. The manufacturer of the wheel then went to the millionaire:

"That roulette wheel," he said, "was the crookedest wheel ever made. I made it and I confess it. I will say to you frankly that it was made primarily for the purpose of skinning you out of a reasonable part of your wealth. The wheel is mine, and when the place was opened in Atlantic City I entered into a contract with my partner that I was to have one third of all the money it made. Now he refuses to stand by the contract and I have come to you to warn you not to pay that $125,000 to him."

"Well," replied the millionaire, "I do not intend to pay him or you or anybody else the $125,000, but if you will get that roulette wheel and set it up here in my house I will give you $25,000."

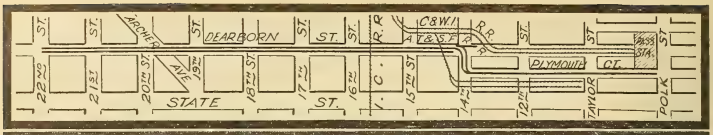
The gambler agreed to the proposition and in a few days the wheel was placed with the rich man's other art treasures and there it is to-day, a thing of beauty, and a great treasure because it is, beyond question, the crookedest roulette wheel in the world.

Electric Power Drainage of a Coal Field

One of the great coal fields of England, some 32 square miles in area, has numerous pumps established at as many different points to pump out the water. Now it is proposed to work these pumps by electricity. They will all be so connected that at a single point the necessary switching can be done to throw them all into action at once. There are 50 pumps in all. If the project is successfully carried out it will be one of the most striking applications of electric distribution and control of power yet presented.

Warships Injured by Electricity

Not long ago an Italian court, after a trial, ordered the removal of some wooden yachts, whose bottoms were sheathed in copper, from the neighborhood of iron warships anchored in the harbor of Leghorn. It was alleged that an electric connection was established through the ships' cables whereby the copper bottomed warships were turned into the poles of a galvanic battery, the result being a rapid corrosion of the iron in contact with the seawater.



CHICAGO'S FREAK CAR LINE

Chicago possesses an oddity in the street car line believed to rival, if not eclipse, anything offered elsewhere in this country. This freak is a full fledged street car line, which in the words of an employe "starts from nowhere and ends nowhere" and takes in an average of five cents a week in fares during the winter and as high as twenty cents a week during the summer. These few precious nickels represent the total return on the cost of operating about one and one-third miles of track, a little more than one-half of which is double track. No trolley pole is visible for the lone car of this railway is operated by a storage battery and the working force consists of a crew of two men—a motorman and a conductor, who by the way are father and son.

THE CAR AND ITS CREW—SHOWING ALSO THE BATTERY CHARGING STATION

The history of the Chicago General Electric Company, as it is called, is shrouded in considerable mystery. Traction experts in the City Hall smile and look wise when it is mentioned—which is on extremely rare occasions. The line had its beginning when a franchise was asked and obtained in 1896 from the Chicago city council. The right of way began at Jackson Boulevard on the north and single tracks were to run south on Plymouth Court and what was then called Custom House Place (now Federal Street). The route was to proceed in a general southerly direction.

All that was ever built, however, was thirteen blocks of single track on Plymouth Court from Polk Street to Fourteenth Street, where the line swerves west to Dearborn Street. Then there are eight blocks of double track to Twenty-second Street, where it comes to an abrupt end. The tracks were laid in 1898. No attempt ever was made to build farther. No traffic came to the line and no prospect appeared in store for the future.

It was just at the lunch hour that the car was found at the Twenty-second Street end.

"Sure," said the gray-haired conductor, "you'll find us here every day between 12:30 and 1:30. We charge the battery for an hour.

"That steam over there," said he, pointing to a hole in the alley paving from which a heavy iron cover lay back, "comes from a fifteen barrel tank of water that we use as a resistance in charging. It gets pretty well 'het up' in an hour. The charging current comes from that piece of trolley run in here for that purpose.

"Yes, I keep that switchbox locked when we are on the road and this charging cable we hang on that big hook up there on the front platform. Come on in."

In passing, the date on the controller was noted as 1895. It is a five point affair and was made by the Walker Company of Cleveland, Ohio.

"You don't use electric heaters?" was asked.

"No, that stove"—pointing to an old type street car stove perched up seat high on one side of the car—"does pretty well. The company don't have any repairs in stock for it either. They had to send out and buy a new fire pot last fall.

"Some days when it's freezing, stormy weather it takes me and my son here all day to clean the track and make one trip to Polk Street and back. Then's when that rack up there over the stove comes in handy. It's where we dry our mittens. We carry that bunch of shovels and picks ye seen on the rear platform and they all git used.

"It'll be thirteen years next October since I started runnin' this road. In good weather we make four round trips a day. Time to go, Tom. You better stay on, mister, we'll reach Polk Street (twenty-four blocks) in 'bout an hour to-day. The runnin's good."

"Tom," shovel in hand, walked ahead clearing away snow and ice here and there. Freight yards and houses, teams and trucks fill the district traversed by the north end of the line. Pedestrians stopped to gaze at the primitive car. At one point a truck blocked the way.

"We don't have to cuss our heads off like them fellers over on State Street. We wait till the driver is ready to move on."

"You want my fare, don't you?" the lone passenger volunteered as Polk Street was reached.

"Gosh! I nearly forgot it. You see we don't keep our money so handy as the pay-as-you-enter men," the conductor remarked after he had used two minutes in finding change for a dime. "Next summer it'll be different. Our regular customers will be riding again," he added as he rang up the only fare he will probably get for a week.

And day after day this freak battery car runs over the entire length of track to keep alive a franchise of possible future value.

Electrical Men of the Times

VLADIMIR KARAPETOFF

"To your request for an appreciation of Professor Vladimir Karapetoff from the personal viewpoint I respond with pleasure alloyed only by the consciousness of inability to express it adequately within the time and space at my disposal. Our acquaintance dates back less than a decade and his technical achievements are quite beyond my comprehension, but a very brief intercourse sufficed to win for him my confidence as a colleague, my admiration as a musician, my esteem as a man, and my affection as a friend." So writes B. G. Wilder, Emeritus Professor, Cornell University, appointed as an instructor by Andrew D. White on the recommendation of Louis Agassiz and whose association with Professor Karapetoff is more like that of a brother than a personal friend.

He gives us further glimpses of this versatile scholar, musician and electrical engineer.

"Several of Mr. Karapetoff's unusual qualities were displayed in connection with a catastrophe that occurred under

my eyes a few years ago. He had just purchased a grand piano on the installment plan but had not yet added it to his insurance. One Sunday evening he played upon it for us. Monday night his house, opposite our own, took fire and burned so rapidly that once he and his wife had left their rooms to ascertain the source of the smoke, they dared not return. Within an hour the piano was in ashes and with it his music, all his other property and the nearly completed manuscript of an extensive work upon his special branch of science. Next day, calm as ever, he attended his duties; he soon began to rewrite the book and finished it in an astonishingly short time; but never by his words or demeanor would it have been suspected that a calamity had befallen him."

Mr. Karapetoff was born in St. Petersburg, Russia, in 1876. It is quite probable that his wonderful versatility in achievement is inherited, for his father (Nikita) was a mechanical engineer while his mother (Anna) was a student of medicine. His common school education was obtained in Tiflis and Baku, Transcaucasia. In 1897 he graduated from the Imperial Institute of Ways of Communication, St. Petersburg, receiving the degree of civil engineer. It was not until two years later that he directed his attention to electricity by entering an engineering school in Darmstadt, Germany. For four years beginning with 1897 he taught electrical engineering in three different colleges in St. Petersburg and lectured to evening classes of the Imperial Gun Works. In 1904 he was made assistant professor of experimental electrical engineering at Cornell University and is now professor in this department. During that year he married Miss Francis Lulu Gillmor of Pittsburgh, whom he met at a course of lectures where they chanced to occupy adjoining seats.

During the summer Mr. Karapetoff has always at hand some engineering work to accomplish. Reference to these "summer jobs," as he terms them, reads like a description of a trip around the world: In 1893, constructing a railroad in Transcaucasia; 1894, assistant locomotive engineer between St. Petersburg and Moscow; 1894, surveying a railroad to Archangel City; 1895, maintenance of way and repair of buildings for St. Petersburg-Moscow Railway; 1896, with the Trans-Siberian Railroad on Lake Baikal; 1899, making power plant estimates for the Lahmayer Electric Company, Frankfort, Germany; 1900, working on harbor electric crane equipment for the Allgemeine Elektricitäts-Gesellschaft, Germany; 1906, designing electrical machinery for the Allis-Chalmers Company, Cincinnati, Ohio; 1907, special testing engineer, Niagara, Lockport & Ontario Company; 1909, designing electrical machinery for the Westinghouse Electrical & Manufacturing Co., Pittsburgh, Pa.; 1910, designing electrical machinery for the General Electric Company, Schenectady, New York; 1911, with J. G. White & Company, New York City.

Besides his work as an engineer and teacher Mr. Karapetoff has contributed freely to both general and engineering literature. Of the former his "On Life Satisfaction" and "Some Life Ideals" are noteworthy; in the latter field his efforts are too many to attempt to note all, but among them are: "The Magnetic Circuit," "The Electric Circuit," "Engineering Applications of Higher Mathematics," and "Concentric Method of Engineering Education."

He is a member of the American Institute of Electrical Engineers, the Society for the promotion of Engineering Education, the American Association for the Advancement of Science and the Sigma Xi Fraternity.

He believes in simple life, simple pleasures and simple, frank ways of treating people and in not pretending to be what he is not. It is his custom to eat simple food twice a day only, and he does not smoke or use liquor. He even avoids the use of tea and coffee, believing that

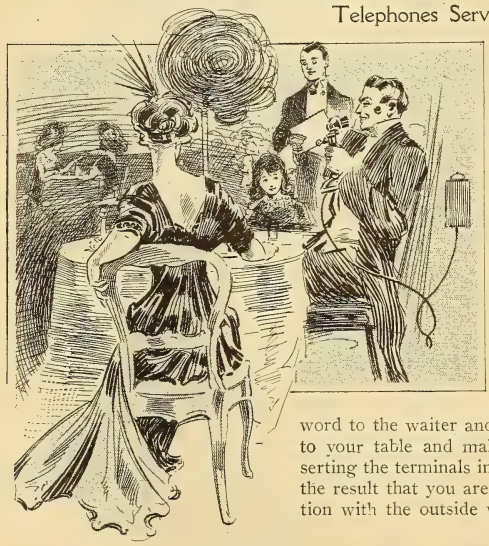
the only stimulation which a man needs is that natural enthusiasm which comes from a right concept of life.

People sometimes ask him how he manages to accomplish much within a comparatively short time. The answer is the habit of systematic work acquired in youth; doing things systematically, even in the matters of recreation and pleasure. Not a minute must be lost without either doing some work or enjoying some pleasure, even though it be the pleasure of watching a little bird. At the same time the very word "hurry" is forbidden in Mr. Karapetoff's house. He even found that his mind works most efficiently when occupied by several problems and for years he has carried on the scheme of practicing on a mute piano and at the same time listening to his wife's reading of some book on history or philosophy.

Notwithstanding his distinct and set opinions in matters political, for he is a strong Socialist, he has numerous friends who belong to all branches and shades of political parties. He sincerely enjoys talking with people whose opinions differ from his own because it allows him to correct his own views and to see the reason for their beliefs.

Mr. Karapetoff considers art to be a necessary part of his life, not something detached from his daily activities, but organically incorporated in them. To him art in all its forms is the most forceful expression of goodness and beauty. In his childhood he was made to study the piano and there was some intention of making a professional musician out of him. Notwithstanding his engineering career he has succeeded in keeping up his technique and appears from time to time in public recitals, but never for money.

Telephones Served With Your Meals



Those who are not in the habit of dining in the great metropolitan hotels and cafés may not be aware of the telephone service given to patrons therein. In these places, where service is the watchword, portable telephones are part of the dining room equipment and stationary boxes or receptacles are located at convenient intervals for the reception of the terminals connected to the long cords attached to the portable phone. A word to the waiter and he brings the instrument to your table and makes the connection by inserting the terminals in the nearest plug box with the result that you are in immediate communication with the outside world during the meal.

The Largest Water Turbine

The photograph from which the accompanying illustration was made lay for a few days on the teacher's demonstration table in a high school physics laboratory. Of course it was examined by the students with great curiosity, and the following questions were asked, over and

BUCKET WHEEL OF THE LARGEST WATER TURBINE

over again: "Is that a ditch digger?" "That's a rotary snow plow, isn't it?" "Is that some kind of a pump?" or "Gee! That's some blower fan!" And when it was on its way west from the factory, mounted on its own special car as shown, it is on record that some people in the small towns through which it passed made it out to be a gigantic cream separator, on its way to Elgin! And one woman of imagination is said to have declared that it looked like a great big iron rose! You see when we meet with an unknown object we at once try to classify it by its resemblance to something we do know about.

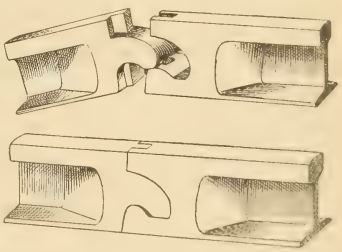
However, those who thought it to be one of the machines mentioned had one right idea, viz., that it was some sort of rotary device. This it shows by its form. It is the "runner" or rotating part of a huge water turbine, and is by this time installed in its casing in the great waterpower plant now being completed at Keokuk, Ia.

The rotor, or "runner" is only one of 30 similar ones, which will ultimately be installed in the great power house. These "runners," the largest of their type ever built, weigh about 130,000 pounds each. When installed, the end with the curved blades goes downward. Through the middle of it runs a steel shaft. This shaft extends upward through the floor of the power house, and attached to its upper end is the rotating magnetic field of a huge alternating current generator.

New Rail Joint

The usual method of fastening rails together at the joint is by means of a flat plate called a "fishplate" secured by bolts and nuts to the rail ends. An improvement and a saving over this construction is shown in the accompanying illustration.

It costs about $742 a mile to put on the fishplates, while the interlocking joint can be used at a cost of $434 per mile—a saving of $308 per mile. The saving may be estimated when it is known that there are 40,000 miles of electric rail-



RAIL JOINT THAT REQUIRES NO FISHPLATE

roads and 275,000 miles of steam roads in the United States and that the average life of a rail is seven years.

Electrical Interests of Women

EDITED BY GRACE T. HADLEY

An April Shower

It was an inoffensive April day. It began with a blue sky, a few fleecy clouds and uncertain sunshine. Little Mrs. Winsome resolved to go to market early that day, so she called up her best friend, Mrs. Minton, and asked if she would like to go also. Mrs. Minton was always ready and soon they were speeding down to the city market.

"I think it is just lovely to get out early these nice Spring mornings," said Mrs. Minton, enthusiastically.

"Yes, indeed," agreed Mrs. Winsome, "and I like to do my own marketing."

"When you have your own car, there is no reason why you shouldn't," commented Mrs. Minton.

"I like to get what I want before it is picked over," observed the practical little housewife.

Soon the two women were elbowing their way through the market, chaffering with the tradespeople and driving close bargains. In the course of an hour or so they emerged, triumphant and parcel laden. Jerry, the chauffeur, piled the packages into a huge basket in the floor of the car beside himself, and away they went. Chug! Chug! The car came to a sudden stop; out jumped Jerry to make an examination. The women were patient until he announced: "Carbureter troubles and other things; she's missing fire in two cylinders."

"Oh, how provoking!" cried Mrs. Winsome, "when I had so many errands to do this morning and now we shall have to go a-foot."

Jerry ran to a nearby telephone booth to send in a distress call and upon his return Mrs. Winsome announced decisively:

"We will get out, as we don't want to be towed in. You may take the market basket with you. Wait a minute, I'll just take that nice juicy steak along with me."

Jerry deftly extracted the brown paper parcel, and handed it to her; then the two passengers left the car to Jerry's tender mercies. They spent the morning going through different shops and inspecting various bargain counters. Mrs.

SOME OF THE WOMEN WERE ELBOWING THEIR WAY THROUGH THE MARKET, CHAFFERING WITH THE TRADESPEOPLE

Winsome picked up such a nice shirt waist for $2.98 marked down from $3.00. The day before it had been $2.50 marked up from $2.00, but as long as she did not know this she was happy in her bargain. Mrs. Minton picked up some lovely table linen, slightly soiled, but then she knew it would all come out in the wash.

Mrs. Winsome felt that she must make some amends for the way the car had acted, so she invited Mrs. Minton to lunch with her; that is, they went to the club where Mr. Winsome was a member and charged the luncheon to him. Afterwards, Mrs. Minton suggested that they attend a vaudeville performance, so she bought the tickets, while Mrs. Winsome checked the beefsteak and other parcels. During the performance, they were much amused by a clever pantomime comedian who utilized glare effect in reducing visual acuteness. The theater was lighted by the indirect system while he and his paraphernalia were dimly illuminated by diffused light from the auditorium and by a little direct light from a crescent moon suspended against a black background. The hazy stage setting made possible a number of mystifying and spooky tricks.

When Mrs. Winsome and her friend emerged from the theater, they found a nice little April shower in progress, so they rushed up to Mr. Minton's office, whereupon Mrs. Minton said she would remain and go home with Mr. Minton. Mrs. Winsome then decided to go home on a street car, as she had planned to have steak and mushrooms for dinner that evening. It was the cook's half day out and on such occasions Mrs. Winsome always prepared dinner in her electric chafing dish. When she cooked steak and mushrooms, Mr. Winsome thought it a dish fit for the gods and this is the recipe she used:

One medium sized steak, one small can button mushrooms, one tablespoon sherry, one cup water, one teaspoon butter, salt and pepper to taste. Place steak in chafing dish, add water and cook slowly

FOUND A NICE LITTLE APRIL SHOWER IN PROGRESS

for fifteen minutes. Add butter, then mushrooms, sherry and seasoning. When heated through, serve on hot plates immediately.

When Mrs. Winsome boarded the street car she secured a seat next to a window and on account of the recent shower all of the windows were closed. Her arms being quite laden with parcels, in order to rest them, Mrs. Winsome placed her shirtwaist bargain in her lap together with a couple of library books. In getting her handkerchief from her handbag, she quite by accident lifted the lid which protects the opening in which the sash rests when the window is open. Without noticing this, she then placed the beefsteak parcel on the window sill. A sudden stopping of the car sent the parcel sliding down into the narrow crevice.

"Oh," cried little Mrs. Winsome in genuine distress, "there goes my beefsteak! How shall I ever get it out?"

A number of heads turned around and persons in the immediate vicinity craned their necks. A kind old gentleman with a ruddy face and white hair said:

"Let me get it for you, Madam." Mrs. Winsome made room for him and he poked his umbrella into the crevice with the result that the steak became more firmly lodged than before. A dapper young fellow, who was a clerk in a bank, then tried to pry it out with his cane, but the cane suddenly snapped and the steak settled itself more closely than ever in its new resting place. A tired business man forgot he was so tired and pushed his way through the crowd to enlist the services of the conductor. Upon learning what the trouble was, the conductor promptly routed two fat men and one thin lady off the rear seat and extracted a crowbar from the seat beneath. Passengers crowded about Mrs. Winsome offering advice and suggestions.

"Did you lose something valuable, Madam?" enquired one.

"I lost my beefsteak," said Mrs. Winsome, on the verge of tears from nervousness and vexation. "It was very nice and I was planning to have it for dinner."

"Here's the conductor with a crowbar; now he will get it for you sure." The conductor poked, jabbed and dug at the obdurate parcel without visible success.

"What's the matter?" demanded a new passenger, who had just boarded the car and passed unchallenged by the P. A. Y. E. box.

"It's no use, Madam," said the conductor, mopping his brow with a highly colored handkerchief. "I can't budge it. You will have to go on to the car shed and mebbe they can get it for you there," and he signaled the motorman to go ahead.

"This has been a perfect April shower of troubles," cried little Mrs. Winsome to the lady who occupied the seat with her and she rehearsed them all beginning with the total depravity of the motor car in the morning and ending with the unreasonable and unaccountable obstinacy of the beefsteak.

IT HAD GIVEN UP THE BEST OF ITS SUBSTANCE TO THE ELECTRIC STREET CAR

"Car shed!" yelled the conductor, "change here for surburban lines. This car is turning in."

All the passengers hurried out, leaving Mrs. Winsome quite alone. The conductor hopped off and disappeared; presently he returned with a couple of yard men armed with axes, crowbars and tongs. After twenty minutes' hard work on the part of three men, the beefsteak was finally dislodged and slowly came to view, a sorry spectacle! The string was gone, the paper wrapper was in tatters and the steak in shreds. It was no longer the juicy morsel purchased in the early morning. It had given up the best if its substance to the electric street car.

"Well," observed Mrs. Winsome ruefully, as she eyed the remains, "this is the first time I ever knew a beefsteak to develop such strong electrical interests!" Then she boarded another car to return home.

When she let herself in the front door of the house, there was Mr. Winsome just taking off his coat and hat. Placing

a brown paper parcel in her hands, he remarked very pleasantly: "Here is a nice beefsteak I just bought at the market on my way home. I was thinking all day how good steak and mushrooms would taste in that new electric chafing dish and—"

"You darling!" cried little Mrs. Winsome, and then to his utter surprise she fell on his neck and wept a shower of April tears.

Chafing Dish Artists

The chafing dish is not a modern utensil, but the application of the electric current to it is the modern feature. Fannie Merritt Farmer states that bronze chafing dishes of unique designs and careful workmanship have been found among the ruins of Pompeii; that Louis XV often amused himself "by making quintessential stews in silver pans," and that Madame Recamier, the beautiful and intellectual society leader whose salon was always filled with a brilliant circle, entertained by the use of a chafing dish.

An Englishman who writes most entertainingly on the subject of the chafing dish says: "Chafing dish cookery bears the same relation to middle class kitchen cookery that the delightful art of fencing does to that of the broadsword. Both are useful but there is a world of subtle differentiation between the two. The average rough and tumble of the domestic saucepan contrasts to the same degree with the deft manipulation of the battery of tiny pans."

Joseph of Savoy offered this advice out of his great wisdom: "Make the good things as plain as possible. God gave a special flavour to everything. Respect it. Do not destroy it by messing."

Given a modern electric chafing dish, a few select condiments, a fork and spoon, an energetic brain—and the possibilities of the utensil are limitless to the enterprising artist of the home. For instance:

LOBSTER PATTIES

The tail part of two boiled lobsters cut into small pieces and season well with salt and pepper and a little lemon juice, one pint of milk, one tablespoon of flour, one large tablespoonful of butter.

In the chafing dish boil a pint of milk; dissolve the flour in cold milk and add

"ONE'S INDIVIDUALITY SHINES FORTH IN THE CHAFING DISH AND IS REFLECTED IN ONE'S SAUCES"

to the hot milk; when thick, stir in gradually the butter and allow it to become quite thick; stir the lobster into the sauce, and when it becomes hot, serve by filling the previously heated shells with the mixture.

CRABS À LA CRÉOLE

Four soft-shelled crabs, one ounce of butter, one small onion and sweet Spanish pepper (not minced), one-half pint strained tomato pulp, one gill of chicken broth, salt, celery salt.

Put into the chafing dish the butter, onion and Spanish pepper, and cook five minutes, stirring well; add the tomato, chicken broth, crabs (each cut in two), salt and celery salt; stir well; simmer seven minutes.

ELECTRIC COOKING IN A PALACE OF INDIA

Electric cooking has found its way into the palace of a Maharajah of India. The kitchen has been equipped with an installation of electric stoves and hot plates. The holes in the foreground of the kitchen are the charcoal burners that were used previous to the installation of electric ranges. There are six three-burner hot plates, four two-burner hot plates of another size, one cabinet range, two table stoves, six self contained electric ovens.

THE ELECTRIC KITCHEN IN THE PALACE

Some of the good points that electric cooking can claim are these; no heat is wasted going up a flue or passing into the surrounding air; directly the heat is no longer needed the current can be turned off and then be obtained again at a moment's notice.

THE PALACE OF A MAHARAJAH OF INDIA

His Highness, the Maharajah of Mysore, India, is much pleased with the installation of electric cooking appliances. They were used during the recent birthday festivities for the preparation of food for 130 guests and were found to be very satisfactory in every way.

In warm countries where the climate is often oppressive, these advantages in the realm of the kitchen are most desirable. Lack of variety in the menu cannot be complained of where cooking appliances such as these are installed for all the work involved lies in the preparation of ingredients for cooking. The dusty, dirty work of starting fires is rendered unnecessary, for heat is immediately supplied upon demand and regulated to a nicety.

With electricity no carbon deposit is formed and electric cooking utensils remain clean and bright.

The Modern Concrete Home

Concrete is the hardened, rock like product resulting from a mixture of cement, sand, gravel or broken stone with water. The popular demand for a fireproof home has led to the adoption of cement concrete as a structural material because of its efficiency and adaptability. It is the most versatile material in use, equally suited to a moderate priced bungalow or to a millionaire's mansion.

Interior views of two different poured concrete houses are shown illustrating the fact that such interiors may be as homelike and cheerful as in houses of brick or other material. In the construction of these poured concrete houses, sectional molds are used secured edge to edge to form troughs or molds into which the concrete is poured. Only two tiers of these plates are required in casting a wall, no matter what the height may be, for, as fast as the wall rises, the plates of the two tiers are raised in alternation.

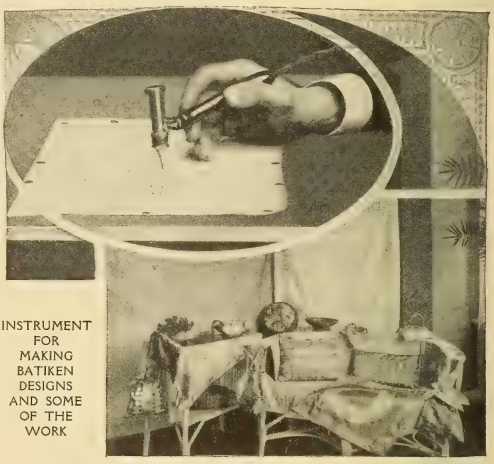
As the pouring proceeds, specially constructed conduits for electric wires are placed in position and wherever there is to be a wall bracket for an electric lamp, a small box-like opening is made, so that the wires may be carried in and out as desired. Thus when the house is finished the conduits are all ready for the electrician.

Wiring the house then becomes a simple matter of pulling the wires through the conduits, which are moisture proof, being simply holes in the solid walls.

INTERIOR VIEWS OF A POURED CONCRETE HOUSE

Batiken Color Designs

What is known as the Batiken method for making color designs upon fabrics appears to have been used in Java from time immemorial, and it is now being taken up in Europe. Very rich and brilliant color designs can be prepared in this way and these are far better than any print process on fabrics could give. The method is especially interesting for amateur work, and the designs and colors can be varied in all imaginable ways.



INSTRUMENT FOR MAKING BATIKEN DESIGNS AND SOME OF THE WORK

A white or colored fabric is used to start with, and a first design is put on it with fluid wax which has been heated in a kind of small pouring or tracing vessel. When the design is traced, the fabric is dipped into a bath of dye such as is used for Easter egg colors or the like. None of the places covered by the wax will take the color, but all the rest will be dyed, for instance in red.

After drying the cloth a second part of the design is put on with the fluid wax. This protects the red color and leaves the rest to be dyed in a second bath, of blue for instance, which combining with the red will give a purple. A third design is put on, then dyeing with another color, and so on. Finally, all the wax is washed out with benzine so as to leave the cloth free, and it then appears with brilliant color designs, should the colors be properly selected.

For this work a new electric heater for tracing with fluid wax is made by Frau Lamprecht-Gewecke, of Kaulbachplatz 15. Nürnberg, Germany. It has a small tube vessel in which the electric heater keeps the wax always fluid, so it will run out of a fine opening below. The picture shows the device and some of the work it will do.

The Domestic Revolution

"Woman and Social Progress" is the title of a new book that discusses the biologic, domestic, industrial and social possibilities of American women; it states that under the domestic system of industry, the home was a complete economic unit, producing most of the goods which were required to satisfy the wants of the family. The industrial revolution, by substituting mechanical power and labor saving machinery for the craftsmanship of the domestic system affected the home in several ways.

The present home industries have been bulwarked by a myriad of inventions. such as the stove, kitchen utensils, sweepers, washing machines, heating systems, sewing machines and the like. Cooking,

cleaning and sewing are still, in part, performed in the home, but in every one of these fields, inventions have materially lightened the housewife's labor.

Electric light and electric heat do much to facilitate the work of the modern home but there are many household duties which these cannot lighten and here appears the need of the electric motor. The uses to which an electric motor can be put in the house are numerous, such as the driving of various household labor saving devices and conveniences. The energy consumption is comparatively small, while in addition to the labor saved the convenience is a great item.

Solidarity in the home under the domestic system was produced by common industry and common responsibilities at home. The material means of producing solidarity has left the home,—another means must therefore be substituted. Social ideals, not material things, must become the binding ties of a home in which solidarity will depend on an ethical rather than a material basis. A similarity of ideas, a conscious or unconscious tending of aims in the same direction must take the place of co-operative home industry. For this new kind of home solidarity, four qualities are essential,—sympathy, compatibility, confidence and mutual aid. With these four qualities as a foundation, the home of the future will afford a new basis for solidarity and social growth almost limitless in its possibilities of development.

Cost of Operating Electric Irons

The cost of operating electric irons is less than the cost of coal for the laundry stove when used only to heat irons. It has been estimated that each worker with ordinary sadirons loses one minute out of every ten in trying to keep them at the right temperature for use. Electric irons maintain their proper heat steadily.

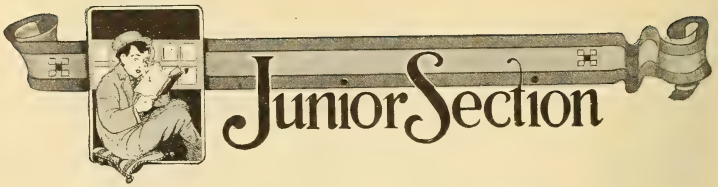
Modern Dusting

For removing dust from around buttons in tufted upholstery there is no other method so rapid and thorough. Health and sanitary cleanliness demand that upholstery and bedding should have this kind of treatment at least once a week. There are always places where dust and germs lodge and places which the maid neglects to clean with a duster because of the inconvenience, but with the different tools that are part of the

REMOVING DUST FROM UPHOLSTERY

electric vacuum cleaner, it becomes a simple and easy matter to clean thoroughly over the tops of doors, plate rails and the tops of picture frames.

"I really do not mind doing my own cleaning nowadays," said a young housekeeper, "since I have an electric vacuum cleaner. I go over the house with it and there is no dust stirred up. All dirt and germs are drawn into a bag. I can clean curtains and pictures without removing them and no fabrics are injured. I would not part with my electric vacuum cleaner because it does away with 90 per cent of the dusting in the old way."



Electricity for the Homes of Swiss Villagers

By ROLAND RICHARDSON *

In going about among the small villages of Switzerland, I noticed that the streets and houses were lighted with electricity, even the real old houses with thatched roofs. This fact interested me, so one day I, with a friend, made a trip of investigation out into the country from Neuchâtel to a little village about eight or nine miles away. We went by train part of the distance and walked the rest of the way. When we got there I noticed right away that they had electricity in most of the houses and as I had my kodak along, I took photographs of some of the houses in which electricity was used. Then as I had gotten this

TRANSFORMER HOUSE IN A SWISS VILLAGE

*Roland Richardson is a reader of this magazine, an Ohio boy who is now living in Neuchâtel and going to school. Switzerland being the land of the "White Coal;" that is, cheap water power, he finds applications of electricity on every hand. It is to be hoped that he will write often for the benefit of readers of the Junior Section and tell of his experiences there in the shadow of the Alps.

deep into the matter, I determined to follow it through to the end. So I followed up the biggest bunch of wires until they came to, and ended in a small stone house, about fifteen or 20 feet high and not over ten feet square. As I got nearer, I heard a low, humming sound coming out of the building, and then, after walking around it, I noticed three small wires leading out of it and going away across a field on some poles. That is how I discovered that it was a transformer station. And I learned something at the same time, for I never knew before that transformers hummed.

I didn't like the idea of following up those three small wires, which, so far as I knew were nothing more or less than wires from a high tension transmission line. I could see where they went out and connected up with it, but as I didn't know which way the main line went, or rather it went two ways, I didn't know at which end the power station was located. So I had to go home, not knowing much more than when I left.

Back in Neuchâtel again, I inquired around and at last found out that there was a big "usine," as they call a power station, about ten miles away on another lake called Bienne, which is joined to the lake of Neuchâtel by a canal.

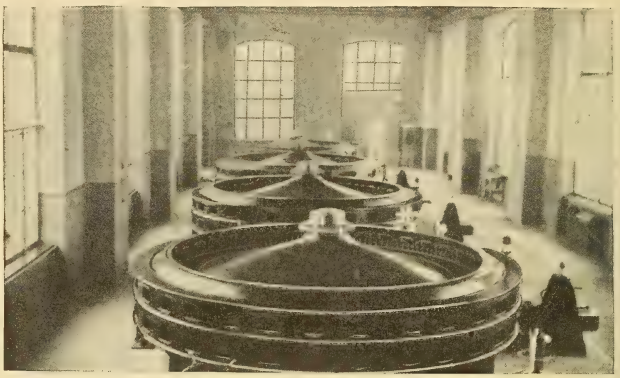
So one Saturday night I determined to go and see it next morning, as Sunday was the only day I had altogether free, because the schools over here don't give us Saturdays, but Thursday and Saturday afternoons.

I started on my bicycle about 10:00 o'clock Sunday morning. It was pretty cold, but the roads were good and I arrived at the power station, which I found named "Hagnek," about half past eleven.

A PICTURESQUE THATCHED COTTAGE IN SWITZERLAND. ELECTRICITY IS USED IN THIS MODEST HOME

But when I got up to the door I found on it *"Entree defendu,"* which means nothing more or less than it wasn't for me to see.

Just then the boss came out and I asked him if I couldn't see the inside, but he shook his head and said that before I could go in I must have a "Carte de permission," from Bienne, a town near-



DYNAMOS IN A SWISS POWER PLANT, DRIVEN BY WATER TURBINES

by where their headquarters were. Then I asked him if he would tell me what kind of dynamos they had and where they sent the "juice," etc., but he wouldn't even do that, and much less would he let me take a photograph of the outside. So I had to get along home again, very much disappointed but not downed.

Then Christmas vacation came along and I decided to go up to Bienne, which was about three-fourths of an hour away by train, and see about my *"carte de permission."*

After much searching on the "Bahnhofstrasse" or "Rue de la Gare," I located the office, and going up stairs I found myself face to face with a push button. I pushed it and a young lady came to the door and saluted me in German and then in French, for I don't know any German and very little French; but she understood what I wanted. After waiting about fifteen minutes I was led into an office room, where a man questioned me as to my wants, etc., and gave me my *"carte de permission"* right away and also the permission to take photographs. I went back to Neuchâtel very happy.

I decided then and there to go the next morning and try my luck again with the boss who wouldn't tell me anything. This I did, taking my lunch and kodak on my bicycle.

A very nice man met me at the door, and when I asked for the boss he told me that he had gone out for the day. So I showed him my permit and he telephoned to Bienne to see about my taking photographs. When he found that I could he just turned me loose and told me I could go anywhere I wanted to, only to be careful.

I shall never forget the sight of those big dynamos. They were at least thirty-five feet in circumference and four and one-half feet high. They were of the vertical type, five of them; three of them were going and their roaring noise made it difficult to hear the explanations, but I found out all I wanted to know about them. One was 1,500 horsepower and the other four were 1,300 horsepower each. The three that were going were whirling around at 100 revolutions per

-minute, generating current at 8,000 volts pressure. The water turbines which drove these dynamos were equally large, only they were below the cement floor and I couldn't see much of them.

The water to run them comes from the River Aar, which runs into the lake at a point further up. They dug a canal about 100 feet wide, straight over from the river to the lake and run the water through the turbines with a fall of about 27 feet.

So here was the place where they make the electricity for most all of the little villages, far and near. Some of them as far away as the real Alps, which are about 50 miles away, and others quite near. Besides all these small villages, they supply the electricity for the whole town of Bienne, with its street cars and all.

So you see how the Swiss look on electricity in their homes. These may be fine city houses or nothing but old houses with thatched roofs, where they keep the cows and horses under the same roof as the family; not as a luxury, but as a necessity.

Aeronautic Advertising

The originator of this new field of advertising is not a New Yorker at all, nor is he an American. His name is Rene Demarest and he is French. This is his plan. He has constructed a number of balloons about 20 feet in diameter and he sells the space on the swelling sides of the gas inflated spheres at a goodly price.

This space is filled with transparent signs advertising everything from chewing gum to vacant buildings and each evening after sunset the balloons are unfettered and allowed to float skyward. Of course they are all captives and when they reach the end of their rope, which is about 500 feet, they bob about in the wind in a most interesting fashion.

But the important part about the balloons is the interior arrangement, which through the ingenious efforts of Mr. Demarest is such that a huge 500 candle-power incandescent lamp can be placed in it.

The balloons are made of translucent silk and through this lighting effect the advertisements, which are also on translucent silk, are made to stand out against the dark night sky in a weird but attractive manner.

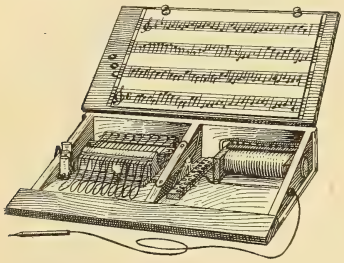
It is this interior arrangement, the secret of the inventor, that makes the balloons so valuable for advertising purposes. Even though the bulbs should break or the wires inside of the bag become short-circuited the gas which inflates the balloon can not be ignited, consequently there is no possibility of dangerous accidents of any kind. The current is supplied by a cable running along the rope which holds the balloon a captive.

ADVERTISING BALLOON WITH ITS INTERIOR ELECTRICALLY LIGHTED

Electric Music Teacher

By using the electric music teacher, children will find that it is an attractive task to learn their notes, instead of a dry lesson as heretofore, so that they will begin to take an interest in music at once and not consider it as a drudgery.

M. Pierre Gélis, a Paris inventor, makes the device which we illustrate here. It is based on the principle of using an electric contact plate under the music paper. By pricking each note with a sharp



ELECTRIC MUSIC TEACHER

metal point, we make contact for an electric device carrying a hammer, so that the hammer strikes a string or preferably a metal piece to give out the sound. Thus each note on line or space gives out its corresponding sound, and it is an easy matter to read a simple piece of music in this way.

The device is quite an elaborate one, for it is required to take care of the sharps and flats which figure permanently as the sign of the staff. But this is easily done by using a revolving contact device to shift over the several required notes at the start. To bring back to natural during the piece, we press on a button which restores the note for the moment.

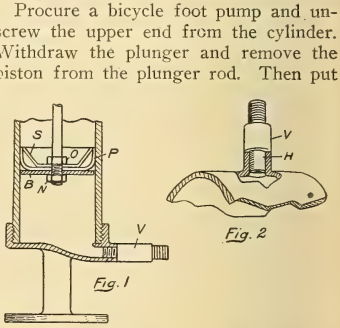
Even professional musicians will find it useful for transposing a piece into another key and this is done by observing the movement of the hammers and also a transposing chart which lies before them.

Laboratory Air Pump from Bicycle Pump

A suction air pump is most serviceable in an electric laboratory for exhausting Geissler tubes, electric eggs and other low vacuum tubes.

A good pump can be made as follows:

Procure a bicycle foot pump and unscrew the upper end from the cylinder. Withdraw the plunger and remove the piston from the plunger rod. Then put



LABORATORY AIR PUMP

the plunger back on the rod in the reverse order, as shown in Fig. 1, where (P) represents the plunger, (B) a metal washer which was previously above (P) and (C) the spider spring which retains the plunger against the wall of the cylinder. (S) and (P) were previously below (B). (O) and (N) are nuts which keep the plunger on the rod.

From an old single tube bicycle tire remove the valve (V), Fig. 2. The rubber is removed from the valve. The small end (H) is threaded. These threads must correspond to those of the air outlet of the pump. If (H) is too large in diameter to screw into the outlet, the latter must be reamed out and tapped. These parts may be threaded by some machinist at a cost of about ten cents. (V), Fig. 1, represents the valve screwed into the air outlet of the pump. Remove the interior of the valve. This may be done with the valve cap, which has a slit cut in it for this purpose. Cut two or three convolutions from the end of the spring with a pair of scissors, before replacing

it. Be sure that the rubber part of it is in a good condition; if it is not, discard it and get a new one, for the value of the pump depends to a large extent upon this.

After replacing the interior of the valve the pump is complete. The rubber tubing leading from the apparatus to be exhausted is slipped over the end of (P).

I have a pump made as above which is not much inferior to the manufactured article.—Wm. H. Dettman.

New York Horse Car in Snow Storm

(From a Brooklynite's Viewpoint)

In winter the question of the best means of preventing tie-ups or delays to traffic on account of snow storms is a very important one to electric railway

By Courtesy Electric Traction

A NEW YORK HORSE CAR

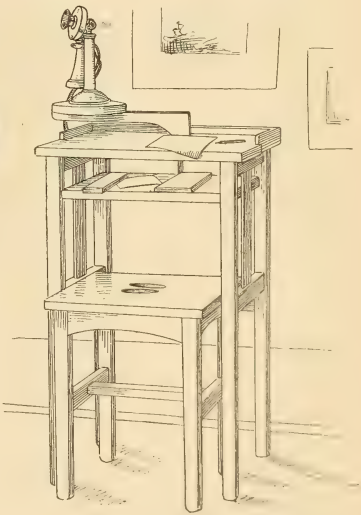
men. This picture showing how the difficulties with snow are overcome in the largest city in the United States may be interesting. While it does not show how the snow is removed from the tracks, it does show "attachments" that are placed on the cars to supply them with increased power.

The "motors" used on these cars are two in number and of only one horse-power each and as more power is needed during and shortly after snow storms the ingenious device shown (two more horses) is made use of, which doubles the power supplied to the car. This attachment can be made and the added power obtained without any increase in the weight of the car. The additional motors can also be attached to or removed from the cars in a few seconds and with only a slight increase in the amount of "control wiring" required.

Owing to the expense of the arrangement it has not found favor in most cities where motors of greater horse-power are normally used. It is only in a progressive city like New York that one can realize that the service rendered by this simple arrangement more than pays for its high first and maintenance costs.

Table for the Residence Telephone

The telephone has become so much an article of the home equipment that furniture manufacturers make specially designed tables for it. These are built to harmonize with the different types of



CONVENIENT TELEPHONE TABLE

furniture. In the illustration the swinging wooden bracket leaves the surface of the table free for writing purposes and also lessens the chance of injury to the telephone by its being accidentally knocked off.

Experimental 200 Meter Wave Sets

By PHILIP E. EDELMAN

PART 2

To operate an experimental set at 200 meters is, after all, not an extreme limitation. According to recent reports, a French wireless position finding project for ships will operate at 150 meters in order to avoid interference with regular wireless communication. This is 50 meters less than the amateur limit with which we are concerned.

In considering the condenser of primary circuit, Fig 4, the discussion will be limited to a spark system and more particularly to one in which a transformer is employed for the charging of the condenser. The quenched spark or arc systems, while particularly suited to a low wave length, because of their higher efficiency, will not be considered at this time because they require a different design for the parts, which would lead to confusion in this discussion.

The primary or condenser circuit operated at 200 meters must have dimensions such that the product of the capacity and inductance is limited to the value of .011257, when the capacity and inductance are expressed in units of microfarads and microhenrys respectively. This value is found by evaluating a wave length formula as has been explained in a previous article (November, 1912). Any dimensions for the capacity and inductance which will give this product are theoretically satisfactory, but if either factor is made too small the other will be too large, or vice versa. Too large a capacity in the condenser, for instance, means that inductance must be cut down to such a small value that good coupling between the condenser and antenna circuits is impossible. Too much capacity, then, may mean that not even a complete turn of a helix can be used in the primary circuit and this item alone will lower the efficiency of the set considerably. If, on the other hand, the condenser is made smaller in order to allow sufficient inductance, another limit is soon reached. Unless the power is reduced to correspond to the size of the condenser, or either the frequency or voltage used to charge the condenser is correspondingly increased, the set will not operate efficiently. If the limit is exceeded the set cannot be operated at all.

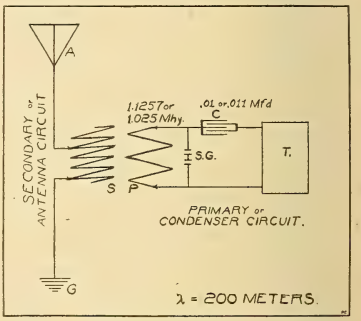


FIG. 4. A—AERIAL; G—GROUND; L—INDUCTANCE WITH PRIMARY P AND SECONDARY S; SG—SPARK GAP; C—CAPACITY; T—TRANSFORMER

It is well known that a smaller capacity may be used when either the frequency or the charging voltage is increased, and this fact may be utilized to keep the dimensions of the condenser circuit within the limit without reducing the power used. The average experimenter cannot obtain the necessary high frequency and must rely upon a high charging voltage if he wishes to use the maximum power at 200 meters. The condenser to be used, then, must be small enough to allow the use of sufficient inductance in the circuit and at the same time be large enough properly to charge and discharge when operated at the given power, frequency and voltage. The frequency being fixed, and with the condenser circuit limited to a fixed value, it is obvious that the voltage must be increased when the power is increased.

CONDENSER CIRCUIT FOR TRANSFORMER

For example, when a power of ¼ kilowatt is used with a condenser of .01 microfarad, the charging voltage should be 7,000 volts. If the voltage is decreased to 6,800, the condenser should be increased to .011 microfarad, or if the voltage is increased the capacity should be decreased. By examining the fixed value for the condenser circuit it will be noted that either .01 or .011 microfarad is a convenient and desirable capacity for the condenser because sufficient inductance to obtain good coupling between the antenna and condenser circuits may then be used. It is obvious that the condenser can be made still smaller to allow a larger margin for the inductance, but that the voltage must then be increased. There are limitations, however, to the point to which the secondary voltage of a given transformer may be increased. The current decreases as the voltage increases with a given power, and too, better insulation is needed throughout. There is more loss in the condenser and the leakage reduces the efficiency as the limit is approached. While the charging voltage may conveniently be increased as the power is increased, the voltage for a ¼ kilowatt transformer should then be below 7,500 for other considerations. A condenser of substantially .01 microfarad charged at substantially 7,000 volts, then, is a suitable arrangement for the 200 meter circuit of ¼ kilowatt capacity. When it is remembered that the total value of the condenser circuit must not exceed .011257 microfarad it becomes plain that a capacity of .01 microfarad allows 1.1257 microhenrys for the total inductance in the circuit.

In order to avoid an increase above .01 or .011 microfarad in the condenser when the power is increased from ¼ to ½ kilowatt, the voltage must be increased from 6,800-7,000 to 9,400-10,000. This means a departure from former practice, as the amperage instead of the voltage has generally been increased with the power. This means further, that a large part of the old transformers having a power of ½ kilowatt and over are not suitable for a 200 meter circuit. In the same manner, when the power is increased from ½ to one kilowatt (maximum power allowed) the voltage should be increased from 9,400-10,000 to 13,000-14,500. It is understood that when these pairs of numbers are given, the lower value corresponds to the use of .011 microfarad, while the higher value (as 14,500 for one kilowatt) corresponds to the use of .01 microfarad. Figure 4 shows the relations of the circuits and the values for the capacity and inductance when a transformer is used. These values (.01-1.1257 or .011-1.025), are, as has been explained, best adapted for all transformers from ¼ to one kilowatt. Indeed, manufacturers of wireless apparatus have in some cases already altered their designs to conform substantially with this limit. There is but little difference between the two, and .01 microfarad is perhaps best adapted as standard. The Clapp-Eastham Co. now supply ¼, ½, and one kilowatt transformers with charging voltages of 6,800

9,400 and 13,000 respectively, to operate a condenser of .011 microfarad. It seems likely that substantially the foregoing values will be adopted and used as long as the present law and regulations remain in force.

CONDENSER CIRCUIT FOR SPARK COILS

In this article the purpose is to consider only such sets as are commonly used. It is for this reason that transformers smaller than ¼ kilowatt and other odd sizes have not been specially considered. The common sizes of spark coils, however, are mentioned because of their general use by the average experimenter. With spark coils, the capacity may be taken as .002 microfarad for every one-half inch of spark length. With this value fixed the following values are found for the condenser circuit by evaluating the relation $L \times C = .011257$.

Spark length in inches.	Condenser capacity in microfarads	Inductance in microhenrys.
½	.002	5.63
1	.004	2.808
1½	.006	1.875
2	.008	1.407

THE CONDENSER

A condenser unit with a capacity of substantially .01 microfarad may be made from ordinary 1/16 inch window glass or old photographic plates 8 by 10 inches, Fig. 5. If photographic plates are used, the emulsion should be removed. The glass should be thoroughly clean and dry before it is used. The tin foil for the coatings should be No. 35 gauge if possible and should be made smooth by means of a photographer's roller. Cut the foil to 6 by 8 inches with a three inch lug, as shown at (A). A less desirable method is to cut the lugs separately, but four inches long, after which they are attached to the coating so that they overlap one inch.

In building the condenser, lay a sheet of glass on a flat table; then place a sheet of foil with its lug on top of it so that the foil lies flat and is evenly spaced from the edges of the plate. Now lay a second glass plate on top of this and place a second sheet of foil on it, spaced as before, but arranged so that its lug comes at the opposite side of the same edge of the plate (B). Proceed as before, placing alternate sheets of glass and foil until 20 sheets of the 6 by 8 inch foil have been assembled with nineteen plates

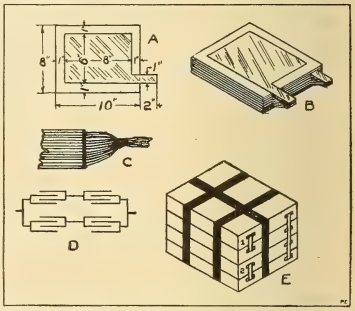


FIG. 5. A—DIMENSIONS OF FOIL AND GLASS PLATE; B—ASSEMBLED PARTS; C—DETAIL OF LUG; D—SERIES-PARALLEL CONNECTIONS; E—FOUR UNITS IN SERIES-PARALLEL

of glass between them. An extra plate should then be used to cover the top sheet of foil. The unit can now be bound together by rubber tape or string. The two respective sets of lugs should be separately clamped between a piece of brass or copper sheet or else soldered to a lead made up of a large number of twisted wires (C). This lead should be at least 3/16 inch in diameter or else equivalent to a copper strip ½ by 1/16 inch. The unit should be carefully constructed and each sheet of glass should be uniformly 1/16 inch thick. For ¼ kilowatt only one unit will be needed, and it can be mounted in a suitable box or jar. The container can then be filled with transformer oil, linseed oil, or vaseline. The condenser should be mounted so that it does not rattle in the container, For ½ to one kilowatt, four units are used, each with the dimensions just given. These are connected in series-parallel as shown in the diagram at (D) and also at (E). This arrangement does not in-

crease the capacity and the combined capacity of all four units connected in this way is the same as that of one single unit. The advantage of this arrangement is that the puncture strength of the four units in series parallel is twice that of a single unit. This arrangement is necessary because of the higher voltages used with ½ and one kilowatt. The four units should be separately assembled and then bound together as shown at (E). All the lugs should be at one end and should be connected with short thick conductors as shown. It is well to solder the joints. Connections are made at (1) and (2) and this end should be up if the condenser is mounted in a box.

By the addition of one more plates to the unit, its capacity will be increased to a trifle less than .011 microfarad. It is understood that any change in the dimensions affecting the area or thickness will alter the capacity. It is important to have good connections and large conductors for the leads.

To construct the capacities for spark coils, use the same dimensions, making each unit with three plates of glass between four of foil. Each unit thus made will have a capacity of substantially .002 microfarad. A desired capacity can then be made up in steps of .002 microfarad (corresponding to steps of ½ inch in spark length) by connecting the units in parallel.

(To be continued)

Wireless Outfit as Moving Picture Attraction

One motion picture manager has put wireless telegraphy to use as a moving picture advertising medium. He had a wireless amateur having a one kilowatt transformer display his apparatus in front of the picture parlor. A small antenna was suspended in the lobby with wires leading from it to both the sending and receiving apparatus. The sending apparatus was mounted on top of the ticket booth, and the receiving apparatus on a table beside the booth.

On the night of the great "wireless show" the amateur operator took a seat at the table, with the receiving headgear on, and operated a telegraph key, which controlled the noisy spark.

The crowd passing by on either side the street was attracted by the noise of the flamy, crashing spark. The spark was mounted in a very conspicuous place on top of the ticket booth, in full view of all, and could be clearly seen from the opposite side of the street.

A sign just above the operator's head, "Wireless Telegraph Station," readily explained the meaning of all the noise, and wireless, being a public curiosity,

CROWDS WILL BE ATTRACTED BY THE CRASHING SPARK

naturally attracted the attention of all who passed by.

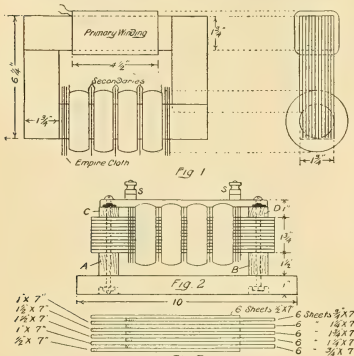
The people would devote a little time to the apparatus, and then the attractive posters of a sinking ship sending the "S. O. S." call, or the like, would have their eyes. And finally many were investing a nickel to see the show.

A New Detector

A Berlin wireless telegraph company has patented a new detector which is formed by the contact of a crystal of molybdenum and of a conducting powder (pulverized silver). The mineral electrode forms the bottom of a closed and insulated box upon which is spread the powder in an even layer; an electrode of large surface is immersed in the powder and connected with the exterior circuit.

Two Hundred Watt Closed Core Transformer

The transformer which is described below is for use on 110 volt, 60 cycle alternating current circuits and may be used without any extra reactance. The secondary potential is in the neighborhood of 5,500 volts and the spark will jump a gap of about ⅜ inch. If the gap be started at ⅜ inch the spark can be drawn



DETAILS OF CLOSED CORE TRANSFORMER

out to 1½ inches and is extremely hot. With a condenser of six metallic plates, 9 by 9 inches, separated by glass 1/16 inch thick, a crashing spark for wireless use is obtained.

The core is composed of laminations of stovepipe iron. The core upon which the primary coil is wound is composed of pieces of the sheet iron 1¾ by 7 inches, sufficient pieces laid upon each other till there is a stack 1¾ inches high. The end pieces for the core are 4½ by 1¾ inches and two stacks of the above size and 1¾ inches high are required. The secondary sections contain a hole two inches in diameter and the leg upon which they are placed has to be 1¾ inches in diameter and seven inches long. In order to make the core round by using the flat pieces of sheet iron it is required to cut the sheets as follows: Six pieces 7 by 1¾ inch; twelve pieces 7 by 1½ inch; twelve pieces 7 by 1¼ inch; twelve pieces 7 by 1 inch; twelve pieces 7 by ¾ inch; twelve pieces 7 by ½ inch.

These are assembled as shown in Fig. 3. In building up the two legs of the core upon which the windings are placed, the sheets should be dipped in shellac varnish before assembling. Every six sheets of iron should be alternated as shown in Fig 3. The core for the primary is of course square and seven inches long. By alternating every six sheets the end pieces of the core can be wedged in more easily.

The legs of the core should be given a layer of friction tape. Two layers of empire cloth should be placed on the primary core and 240 turns of No. 16 double cotton covered wire wound on and leads about six inches taken out for connections. A layer of tape will hold the coil firmly in place.

The secondary is composed of four Dawson-Winger Company's units, 1⅛ inches thick, size hole in the center two inches and wound with No. 34 wire. The core is wound with about five layers of empire cloth and the sections slipped on over this, and a sheet of empire cloth placed between each unit and two or three sheets at the ends to insulate the secondary from the end pieces of the core. The end pieces of the core are then wedged in their proper slots as shown in Fig. 1. The electrical part is almost complete now and all that is required is the joining of the wires in the secondary. These ought to be soldered together with the aid of some non-corrosive flux and solder.

Fig. 2 is self explanatory to show how the transformer is mounted. The base, preferably oak, is 8 by 10 by 1 inch. On this base the pieces (A) and (B), Fig. 2, are mounted. These pieces are 7½ by 1½ by 1 inch. The pieces (C) and (D), Fig. 2, clamp the core down to the pieces (A) and (B) by means of the bolts, as

per diagram. (C) and (D) are 7½ by ½ by 1 inch.

The piece (E) is screwed on to the clamp pieces (C) and (D) and the secondary and primary binding posts are connected. (E) is of oak 8¼ by 3½ by ½ inch. After completion give the transformer a coat of good stain and varnish.—Alex Polson.

Judgment for the Marconi Company

On the 24th of December last, in Paris, judgment was rendered in a suit brought by the Marconi Company against La Société Français Radio-Electrique, La Compagnie Générale Radiotélégraphique and the Société des Transports Maritime, for infringement of patent. Edouard Seligmann, who represented the Marconi company, is the same lawyer who won the claims of the Wright brothers in the French courts some years ago. The judgment affirms the validity of the Marconi patents, forbids the defending companies to continue their infringements, orders the confiscation and destruction in all places of their appliances and condemns them to pay damages to be fixed by the state. It orders, besides, the insertion of the condemnation in the French and foreign journals. The Marconi company's rights have already been established by the English, German and American courts.

Canadian Boats Compelled to Carry Wireless

The Canadian government has undertaken to compel all vessels carrying over 50 passengers and plying between ports 200 miles apart to install wireless equipment with a skilled operator. The Minister of Marine, Hon. J. D. Hazen, is inclined to bring excursion vessels on much shorter runs under the terms of the act, but will first summon the interested parties to a "round table" conference. The act is so framed that entry to Canadian ports will be denied vessels refusing to comply, and a system of fines is also available.

New York Clubs Form Relay

The Amateur Wireless Association of Schenectady, N. Y., the Chester Hill Wireless Club of Mt. Vernon, N. Y., the Frontier Wireless Club of Buffalo, N. Y. and the Rockland County Radio-Wireless Association of Nyack, N. Y., have united in an effort to establish a relay between Buffalo and New York. Amateurs in New York state who have either sending or receiving stations are invited to send name and address, call letter and power to John F. Diehl, Secretary of the Gramercy Wireless Club, 207 E. 25th Street, New York.

WIRELESS CLUB DIRECTORY

This directory of amateur wireless clubs and associations will be published quarterly. When a new club is formed the names of the officers, also the street address of the secretary, should be forwarded to us at once. Any changes that should be made in the directory, when designated by an official of a club, will be made in the next issue in which the directory appears, after receipt of such advice.

Aerogram Club.—Walter B. Clarke, 17 May St., Newport, R. I., Corresponding Secretary.

Aerograph Club of Richmond, Ind.—James Pardieck, 320 South 8th St., Richmond, Ind., Secretary.

Aero Wireless Club.—D. Beard, Napa, Calif., Secretary and Treasurer.

Allegheny County (Pa.) Wireless Association.—James Seaman, Leetsdale, Pa., Secretary and Treasurer.

Alpha Wireless Association.—G. F. Girton, Box 57, Valparaiso, Ind., Secretary and Treasurer.

Amateur Wireless Association of Schenectady, N. Y.—A. R. Toft, R. F. D. 49, Schenectady, N. Y., Secretary.

Amateur Wireless Club of Geneva (N. Y.).—Benj. Merry, 148 William St., Geneva, N. Y., Secretary.

Arkansas Wireless Association. — Edward Vaughn, 2622 State St., Little Rock, Ark., Secretary and Treasurer.

B. W. T. A. Wireless Club.—C. H. Smith, Scarsdale, Pa., Secretary.

Back-Bay Wireless Club of Boston.—John P. A. Davis, Readville P. O., Mass., Secretary.

Berkshire Wireless Club.—Jas. H. Ferguson, 18 Dean St., Adams, Mass., Secretary.

Canadian Central Wireless Club.—Harold P. Mott, 9 Central Ave., Armstrong's Point, Winnipeg, Manitoba, Can., Secretary.

Cardinal Wireless Club.—Miss A. Peterson, South Division High School, Milwaukee, Wis., Secretary.

Chester Hill Wireless Club.—Richard D. Zucker, 16 Clinton Place, Mt. Vernon, N. Y., Secretary and Treasurer.

Chicago Wireless Association.—F. D. Northland, 24 Scott St., Chicago, Ill., Corresponding Secretary.

Coatesville Radio Telegraphy Association.—Geo. H. Newlin, 326 Charles St., Coatesville, Pa., Secretary.

Colorado Wireless Association.—W. F. Lapham, 1545 Milwaukee St., Denver, Colo., Secretary and Treasurer.

Custer Wireless Club.—Walter Maynes, 438 Custer Ave., Los Angeles, Cal., Secretary.

De Kalb Radio-Transmission Association.—Bayard Clark, 205 Augusta Ave., De Kalb, Ill., Secretary.

Electrical and Wireless Club.—Clyde Stillwell, 108 Kappell Ave., Council Bluffs, Ia., Secretary.

Electro Mechanical Association of Columbus, Ohio.—John Dolby, 512 W. State St., Columbus, Ohio, Secretary.

Fargo Wireless Association.—Earl C. Reineke, 518, 9th St., Fargo, N. D., Secretary.

Forest Park School Wireless Club.—William Crawford, R. F. D. No. 1, Springfield, Mass., Secretary.

Frontier Wireless Club.—George S. Franklin, 1034 Elmwood Ave., Buffalo, N. Y., Secretary and Treasurer.

Geneva Wireless Club.—Henry B. Graves, Jr., 448 Castle St., Geneva, N. Y., Secretary.

Germantown Wireless Association.—George C. Blackwood, 5346 Germantown, Philadelphia, Pa., President.

Gramercy Wireless Club.—John F. Diehl, 207 E. 25th St., New York, N. Y., Corresponding Secretary.

Granby High School Electricity Club.—Eastman Smith, Granby, Mass., Secretary and Treasurer.

Greater Huntington Wireless Club.—Frank L. Murphy, 201-203 Main St., Guyandotte, W. Va., Secretary and Treasurer.

Greenfield Wireless Association.—Stanley B. Wolfe, 4125 Haldare St., Pittsburg, Pa., Corresponding Secretary.

Hamilton Wireless Association.—H. N. Swain, 405 Franklin St., Hamilton, O., Secretary.

Hannibal (Mo.) Amateur Wireless Club.—G. G. Owens, 1306 Hill St., Hannibal, Mo., Secretary.

Harriman Wireless Association.—Everett R. Parish, 801 Clinton St., Harriman, Tenn., Secretary.

Haverhill (Mass.) Wireless Association.—Leon R. Westbrook, Haverhill, Mass., Secretary and Treasurer.

Hobart Wireless Association.—Charles Clifford, Hobart, Ind., Secretary.

Independence Wireless Association. — Joseph Mahan, 214 South Sixth St., Independence, Kan., Vice President.

Independent Wireless Transmission Co.—Harlan A. Eveleth, 72 Gray St., Arlington, Mass., Secretary.

Jonesville Wireless Association. — Merritt Green, Lock Box 82, Jonesville, Mich., Secretary.

Killington Radio Club of Rutland, Vermont.—W. R. Canty, Rutland, Vt., Secretary.

Lake View Wireless Club.—R. F. Becker, 1439 Winona Ave., Chicago, Ill., Secretary.

Lane Radio Association.—R. R. Traub, 2147 Lincoln Place, Chicago, Ill., Corresponding Secretary.

Lexington Aerogram Company. — Charles Young, 5 Warren St., Lexington, Mass., Secretary.

Long Beach Radio Research Club.—Bernard Williams, 555 E. Seaside Bvd., Long Beach, Calif., Secretary.

Manchester, (N. H.) Radio Club.—Earle Freeman, 759 Pine St., Manchester, N. H., Secretary.

Minneapolis Wireless Club.—John L. Ewart, Minneapolis, Kans., Secretary.

New Haven Wireless Association.—Russell O'Connor, 27 Vernon St., New Haven, Conn., Secretary and Treasurer.

New Thomson Wireless Club.—Edward M. Fleming, care the New Thomson, Kane, Pa., Secretary.

Niagara Falls Wireless Association.—J. J. Dobbie, Jr., 7 Buffalo Ave., Niagara Falls, N. Y., Vice President and Secretary.

Non-interference Wireless Association of America.—Gerald E. Travis, 1062 Saratoga St., East Boston, Secretary.

Northwestern Wireless Association.—L. J. Healy, 3349 Lincoln Ave., Chicago, Ill., Corresponding Secretary.

Oakland Wireless Club.—W. R. Sibbett, 916 Chesten St., Oakland, Calif., Secretary.

Oklahoma State Wireless Association.—Ralph Jones, Box 1448, Muskogee, Okla., Secretary and Treasurer

Oregon State Wireless Association.—Clarence Bischoff, Lents, Ore., Treasurer and Corresponding Secretary.

Panama-Pacific Wireless Club.—F. A. T. Browne, 1553 Muth St., Oakland, Cal., Secretary.

Peterboro Wireless Club.—E. W. Oke, 263 Engleburn Ave., Peterboro, Ontario, Can., Secretary and Treasurer.

Plaza Wireless Club.—Myron Hanover, 156 E. 66th St., New York, N. Y., Secretary and Treasurer.

Pueblo Wireless Club.—K. G. Hermann, 100 Board of Trade, Pueblo, Colo., Secretary.

Radio-Signal Club of Chicago.—F. H. McCarthy, 2113 Washington Bvd., Chicago, Ill., Secretary and Treasurer.

Radio Wireless Club of America.—George Burghard, 1 East 93d St., New York, N. Y., Secretary.

Rockland County Radio Wireless Association.—P. Haeselbarth, Nyak, N. Y., Secretary.

Roslindale (Mass.) Wireless Association.—Fred C. Fruth, 962 South St., Roslindale, Mass., Secretary.

Sacramento Wireless Signal Club.—W. E. Totten, 1524 "M" St., Sacramento, Calif., Secretary.

Santa Cruz Wireless Association.—Harold E. Sentor, 184 Walnut Ave., Santa Cruz, Calif., Secretary and Treasurer.

Seneca Electrical Club.—Howard Donnelly, R. F. D. 1, Geneva, N. Y., Secretary.

Southeastern Indiana Wireless Association.—H. Hitz, Fairmont, Madison, Ind., Corresponding Secretary.

Southern Wireless Association.—P. Gernsbacher, 1435 Henry Clay Ave., New Orleans, La., Secretary and Treasurer.

Springfield (Mass.) Wireless Association.—D. W. Martenson, Secretary; Club Rooms, 323 King St., Springfield, Mass.

Spring Hill Amateur Wireless Association.—H. P. Hood, 2nd, 2 Benton Road, Somerville, Mass., Secretary and Treasurer.

St. Paul Wireless Club.—L. R. Moore, 1911 Ashland Ave., St. Paul, Minn., Secretary.

Stoneham Radio Association.—Wendell Smith, 33 Warren St., Stoneham, Mass., Secretary and Treasurer.

Tri-State Wireless Association.—C. J. Cowan, Room 1001 Fails Building, Memphis, Tenn., Recording Secretary.

Waxbury Wireless Association. — H. M. Rogers, Jr., 65 Elizabeth St., Waterbury, Conn., Secretary.

Wireless Association of Atlantic City.—Room 314 Bartlett Building, Atlantic City, N. J.

Wireless Association of British Columbia.—H. J. Bothel, 300 Fourteenth Ave. E., Vancouver, B. C. Corresponding Secretary.

Wireless Association of Canada.—W. C. Schuer, 139 Harvard Ave., Quebec, Can.

Wireless Association of Fort Wayne.—Adolph Rose, 1326 E. Wayne St., Fort Wayne, Ind., President and Secretary.

Wireless Association of Montana.—Harold Satter, 309 South Ohio St., Butte, Mont., Secretary.

Wireless Association of Savannah.—L. H. Cole, Cor. Liberty and Price Sts., Savannah, Ga., Secretary.

Wireless Club of Baltimore.—Winters Jones, 728 Monroe St., Baltimore, Md., Secretary.

Wireless Club of the Shortridge High School.—Robert C. Schimmel, 2220 N. Penn St., Indianapolis, Ind., President.

Y. M. C. A. Wireless Club of Williamsport, Pa.—Lester Lighton, 211 W. 4th St., Williamsport, Pa., Secretary.

Zanesville Wireless Association.—Rudolph C. Kamphausen, 105 South Seventh St., Zanesville, Ohio, Secretary and Treasurer.

For Practical Electrical Workers

Knob and Tube and Cleat Wiring

By H. B. HARTMAN

Knob and tube and cleat wiring are inexpensive and safe when properly installed. These systems find wide application in factories and mills and in places where appearance is of little consequence. They are also used for running feeders in tunnels and in specially built feeder shafts in fireproof buildings. The wires may be single braid, rubber covered, or provided with a slow burning weatherproof insulation. The exceptions to the use of slow burning wire are in cellars, under roofs and in other places exposed to moisture. Wires must be supported at least every 4½ feet except in mill buildings, where a support on each beam may be approved for wires larger than No. 8 if they are separated at least six inches. Wires must in dry places be separated ½ inch from the surface wired over, and spaced 2½ inches apart for voltages below 300. Above 300 volts and up to 550 volts wires must be separated from the surface wired over by at least one inch and must be spaced four inches apart. In wet places wires must be separated from the surface wired over by at least one inch for voltage below 300.

Wires must be protected on side walls from mechanical injury and when crossing floor timbers in cellars or in rooms where they might be disturbed, Fig. 1, wires must be attached by their insulating supports to the underside of a wooden strip or "running-board" not less than ½ inch thick and three inches wide. Instead of running-boards, guard strips on each side of and close to the wires may be substituted. The strips should be at least ⅞ inch thick and should be as high as the insulators. Wires should also be protected by porcelain tubes when passing over pipes, wires, or any other conducting material, Fig. 2.

Suitable protection on side walls should extend not less than five feet from the floor, Fig. 3. This may consist of substantial boxing, providing an air space of at least one inch around the conductors and closed with a sloping top (the wires passing through porcelain bushed holes), or of approved wrought iron conduit or commercial wrought iron pipe. When common pipe is used the insulation of each wire must be reinforced by approved flexible tubing extending from the insulator next below the pipe to the one next above it. Where single braid, rubber insulated wire is used in conduit, the tubing protection must be provided. Where double braid insulated wire is used in conduit, the flexible tubing can be omitted but each end of the pipe must be provided with an approved outlet box. The two or more wires of a circuit, each with its approved flexible tubing, if carrying alternating current, *must*, or if carrying direct current may be placed within the same pipe. In damp places the wooden boxing may be preferable because of the precautions which would be necessary to secure proper insulation if pipe were used. With the exception, how-

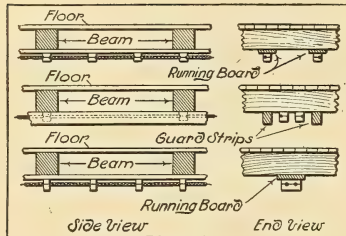


Fig. 1

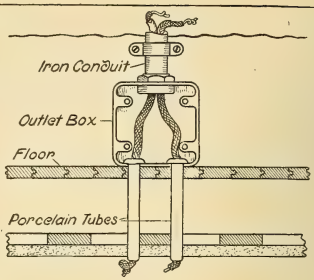


Fig. 4

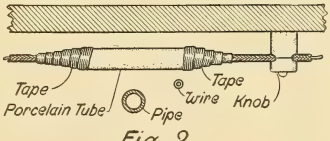


Fig. 2

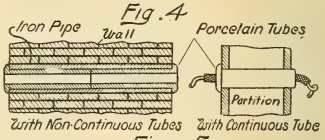
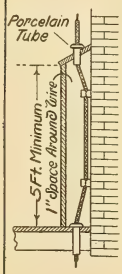
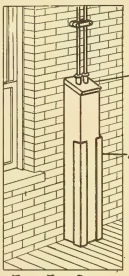


Fig. 5





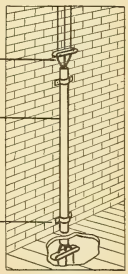
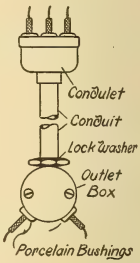


Fig. 3



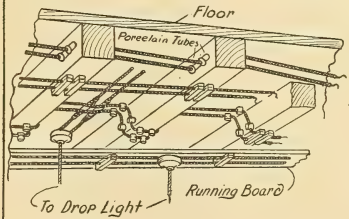


Fig. 6

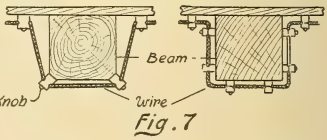


Fig. 7

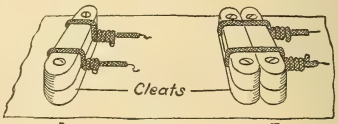


Fig. 8

ever, iron pipe is considered preferable to wooden boxing and its use is strongly urged. It is especially suitable for the protection of wires near belts, pulleys, etc. Fig. 4 shows an outlet arrangement with a square conduit outlet box at the floor.

Where conductors pass through floors, walls or partitions they must always be protected. Open work wires can be protected with porcelain tubes, Fig. 5. The tube or bushing must be long enough to bush the entire length of the hole in one continuous piece, or else the hole must first be bushed by a continuous waterproof tube. This tube may be a conductor, such as an iron pipe, but in that case an insulating bushing must be pushed into each end of it, extending far enough to keep the wire absolutely out of contact with the pipe.

Methods of carrying exposed wiring around and through beams are illustrated in Fig. 6 which shows knob and tube and cleat arrangements. In Fig. 7 are shown, further, two different ways of getting around beams and timbers.

The method of dead ending on a cleat at the end of a run is illustrated in Fig. 8, (I). After the wire is passed through the groove the free end is given several short turns around the line. Where a long run is dead ended it is often advisable to so fasten two sets of cleats that one bears against the other so that both will assume the strain as shown in Fig. 8, (II).

Rosettes for open surface wiring are used to connect the drop cords for the incandescent lamps to the branch circuit wires. A rosette with protected (concealed) contact lugs, is preferable to one with exposed lugs. Fig. 9 shows one type.

Switches can be supported in exposed surface wiring as shown in Fig. 10. Small porcelain knobs may be used to support the switch, Fig. 10, (I), which permits the conductors to be brought through the back of the switch without touching the supporting surface. The switch can be mounted on a commercial porcelain switch block, Fig. 10, (II). Sub-bases of non-combustible insulating material which will separate the wires at least ½ inch from the surface wired over must

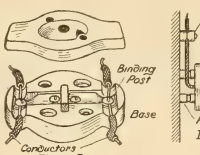


Fig. 9

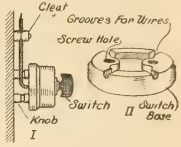


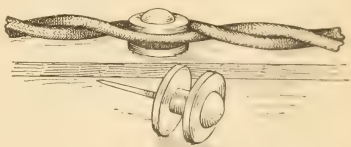
Fig. 10

be placed under all snap switches in this class of work.

Different approved methods of exposed surface wiring as arranged in a building of mill construction, are illustrated in Fig. 6. Which method should be used in any particular case is a matter that is largely determined by the size of wire involved and other local conditions.

Insulating Nail

In hunting trouble on bell or similar circuits it is frequently found that the cause is a "short" under one of the staples or other holding devices, generally due to driving the staple in too far.

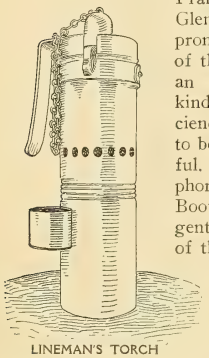


INSULATING NAIL

This trouble may be eliminated by using the Eureka insulated nail, the collar of which, as shown, prevents any undue pressure upon the insulation of the wire and further provides additional insulation between the wires and the metal of the nail.

New Torch for Linemen

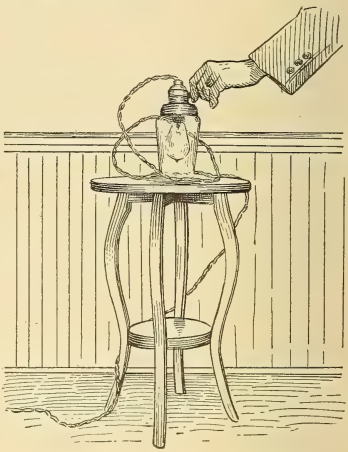
Although simple in construction the wire-joint soldering torch invented by Frank D. Booth of Glendale, Calif., promises, on account of the great need of an article of this kind and the efficiency of this lamp, to be highly successful. Being a telephone lineman, Mr. Booth saw the urgent need of a lamp of this kind and he, after a year of work, invented this one. The torch is cylindrical in form and is about ten inches tall. It is two inches in diameter, weighs about a pound and burns either alcohol or oil. It is carried by means of a hook on the upper side of the lamp, the hook slipping easily over the lineman's belt. It takes but a moment to unhook the lamp, place it in position on the wire and light it. It has been demonstrated that the hardest wind will not extinguish the flame. The lack of weight is one of the torch's principal features. It is a time saver and economizer in fuel.



LINEMAN'S TORCH

Bed Warmer

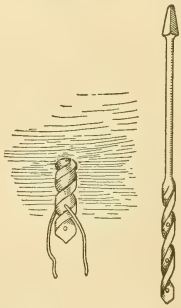
As most people are aware, it is dangerous to use an incandescent lamp as a bed warmer owing to the fact that a considerable amount of heat is given off by a comparatively small body—the lamp. This heat is confined and not allowed to radiate because the bedclothes pack tightly around the lamp. More than once fires have been started from this cause. But I have found that no harm is done if the lamp is enclosed in a fruit jar as shown in the sketch. I solder an ordinary lamp socket into the metal top of the jar and a two to four candlepower lamp will give sufficient heat. The size of the jar prevents packing of the covers too closely around the lamp and permits radiation of the heat fast enough to keep the temperature down to a safe point.—Wilbur R. Simpson.



LAMP IN A GLASS JAR AS A BED WARMER

Combined Fish Wire and Drill

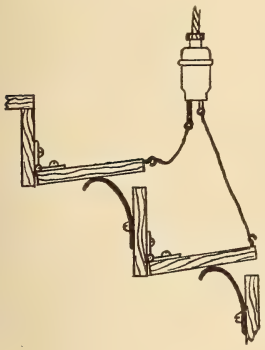
Much time is frequently lost on wiring jobs in fishing wires. This may be avoided to some extent by the use of the drill shown. In using it, drill the hole, slip the end of the wire through the fish hole at the point of the bit, pull out the bit and the wire is drawn through the partition with it.



FISH WIRE AND DRILL

Steps Turn off Cellar Light

The accompanying drawing shows a way to prevent the waste of current by leaving the basement light burning. Two steps near top of the stairs are hinged at the backs and capable of moving up and down about one inch at the outer edge. Hung above them near the side wall is a pull chain socket switch which is connected to control the basement light.



STAIR STEP SWITCH

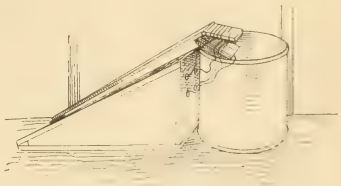
Two eyes are screwed into the outer corners of hinged steps and connected by stout strings to the two "pulls" of the switch. Then on going down stairs the upper hinged step is first pressed down but does not operate the switch as it is already in "off" position. On stepping on the lower hinged step, however, the "on" position of switch is pulled out, thus turning on the light. On coming up the operation is reversed.

While the drawing shows two adjoining steps hinged there should be one solid one between, otherwise at the instant of stepping from one to the other the weight will be partly on both, thus breaking the strings or straining the pull switch.

Two small spring strips serve to lift the weight of the steps after the operator's weight is removed. Two pieces of an old clock main spring will do for this.—James P. Lewis.

Electrical Rat Trap

The latest of the many forms of rat traps to have been devised is one constructed by Millis Knickerbocker of New Lenox, Ill. A wooden box with an incline cover is placed beside a deep tin can with perpendicular sides. At the end of the cover is a hinged platform held in place over the can by springs. This platform is connected by a copper wire with one side of the primary circuit of an induction coil, and two dry batteries are located inside the box. A small hook to which bait is fastened is attached in front of the platform. The only way in which the rat can get to the attractive morsel is by way of running up the incline cover and onto the platform, which is immediately pressed downward by the weight of the rodent's body. The downward move of the platform to the shelf under it, to which the other side of the primary circuit is attached, causes the primary circuit connection to



RAT TRAP

be closed. The electrical current which is suddenly developed by the secondary winding is then sent into a pair of copper wire windings on the platform. This gives the rat a severe shock and hurls it into the tin can, from which no rat can escape. The platform springs back into place just as soon as the rat leaves it

Elementary Electricity for Practical Workers

By W. T. RYAN

This important series of articles, after a brief historical introduction and statement of elementary laws and principles, will be devoted to industrial uses of electricity and extend to such subjects as calculation of wiring, discussion of circuits, handling of dynamos, motors, storage batteries, arc lamps, wireless apparatus, etc. The author, who is Assistant Professor of Electrical Engineering, of the College of Engineering, University of Minnesota, will handle this subject in a manner to be of the most benefit to the practical electrical worker. In fact, it will be a "Plain English" series with mathematics, where used, of the very simplest kind.—Editorial Note.

Chapter I — Historical Sketch

Since it is a matter of experience that nothing will fix a fundamental principle better than *rediscovering* it in its own environment, and since every engineer should know something about the history and romance of his profession, the writer proposes to take up at the outset, very briefly, the history of the development of electrical engineering. Most of the fundamental magnetic and electrical principles were discovered quite by accident, by men who were groping about in the dark for an invisible something just as many men are doing to-day.

A study of the history of electrical engineering shows that it may be divided roughly into three periods: (1) The period of mystery, from the beginning up to 1600; (2) The period of scientific investigation and preparation, from 1600 until about 1873; (3) The commercial epoch from 1873 to the present time.

Period of Mystery—B. C. to 1600

This period has been so named by Professor Norris of Cornell University because of the attitude of the people toward the few known phenomena at this time.

The Chinese are said to have made use of the permanent magnet as a compass several thousand years B. C., and the Greeks are supposed to have used the loadstone at the siege of Troy about 1000 B. C. The first authentic knowledge we have, however, of the use of the compass is by Dutch mariners about 1100 A. D. In 1576 the "dip" of the compass needle was discovered by a compass maker who found it necessary to weight down the south seeking pole.

Knowledge of static electricity dates back before the Christian era. Early Greek and Latin writers described the property which amber possesses, when rubbed, of attracting and repelling light bodies. The word "electricity," invented by Gilbert, is derived from the Greek word meaning amber.

The only practical use made of either electricity or magnetism up to the end of this period was the mariners' compass. The relation of electricity and magnetism was not even suspected.

Period of Scientific Investigation and Preparation—1600-1873

In 1600 Dr. William Gilbert, advisory physician to Queen Elizabeth, published his chief work, "de Magnete," containing the results of his laborious and expensive research. He collected and absorbed the knowledge of his time, corrected and verified numerous hypotheses, disproved a number of fallacies and put the study of electricity and magnetism on a sound scientific basis.

An epoch was made in the science of electrical engineering by Stephen Gray who rediscovered that certain bodies had the power of conducting electricity and that others had not. He divided materials into the two great classes—conductors and non-conductors.

The Leyden jar was invented by a monk named Kleist in 1745. It was called a Leyden jar because of the fact that it was invented and tried in Leyden.

In 1752 Benjamin Franklin demonstrated that lightning and electricity are one and the same thing by means of his famous kite experiment.

In 1767 in a paper read, probably at Paris, Sulzer added in a footnote the following remarkable passage:

"If two pieces of metal, the one of lead and the other of silver, be joined together in such a way that their respective edges may form but one plane, and if they be thus placed on the tongue, a taste will be perceived quite similar to that of vitriol of iron; nevertheless, if either of these pieces of metal be separately applied no vestige of such a taste is left. It is not probable that by the junction of these two metals any solution of either occurs, or that the dissolved particles insinuate themselves into the tongue. It must, therefore, be concluded that the junction of these two metals causes in one or the other, or in both, a vibration of their particles, and that this vibration necessarily affects the nerves of the tongue and produces the taste mentioned."

It was probably between 1760 and 1790 that Dr. Luigi Galvani first made the discoveries which have made him celebrated. He was struck by the muscular contraction of the frog when its bare muscles were touched by two metals in contact at the ends away from the frog. He tried to account for his observations by assuming that the nerves of the animal body formed a kind of Leyden jar, which was discharged by the metals whenever they were brought in contact.

Professor Alessandro Volta at first agreed with Galvani, but his own experiments soon led him to change his opinion. Volta explained the action of the frog as due to the metals in contact with the frog's muscles generating electricity whenever their outer ends were brought in contact.

Sir Humphry Davy of England in 1802 with the aid of a large number of voltaic cells heated a platinum wire to a white heat and produced an arc between carbon points. The invention of the electric light indicated very forcibly the practical possibilities of the then rapidly developing science. In 1807 Davy also produced chemical decomposition by means of electric currents.

In 1820 Professor Hans Christian Oersted of Copenhagen accidentally discovered that a magnetic needle or compass could be deflected by a galvanic (or voltaic) current of electricity, the compass needle tending to place itself at right angles to the conductor in a definite direction. The experiment illustrates the electro-magnetic effect between a current and a magnet and was the first proof that electricity and magnetism are related to each other.

Note at this point that experimenters had currents of electricity at their disposal in 1800. Therefore it was 20 years before some one accidentally brought a compass near a wire carrying current and noted the effect on the compass

One week after Professor Oersted's discovery, André Marie Ampère of Lyons, France, discovered that two parallel conductors carrying a current mutually attract or repel one another, attracting when the currents are in the same direction and repelling when in the opposite direction.

In the same year both Davy and Dominique-François Arago of Paris discovered that magnetism could be produced in iron and steel by electric currents.

In 1825 Arago performed his well known experiment in which a metal disk was revolved before a magnet. He found that the magnet tended to follow the disk.

In 1826 the law of the electric circuit was discovered by Dr. Ohm by noting that the effect of the current from a battery varied as the resistance of the circuit, and also that when the same resistance was used that the effect varied as

the number of cells in series; that is, with the voltage.

Michael Faraday of London (a green boy who was picked up by Davy and who was later hindered considerably in his work because of the jealousy of Davy's wife) became very much interested in what was going on in Davy's laboratory and in 1831, after five years spent in experiments to prove it, announced his discovery of the electro-magnetic induction of currents. His first experiments related to the production of currents in a coil by means of currents stopped or started in a neighboring coil; hence the prototype of the modern transformer. His next step was to rotate coils of wire in strong magnetic fields, thus producing the prototype of the modern dynamo.

In 1833 Faraday discovered and stated the laws of electrolysis.

In 1834 Gauss and Humboldt organized the German Magnetic Union and began observations for the purpose of investigating the course of terrestial magnetism and its changes. It may be of interest at this point to note that now some people believe that the earth is an electro-magnet instead of a magnet, and that our terrestial magnetism is caused by currents of electricity flowing around the earth from east to west, the cause of these currents being the sun.

In 1836 Daniell invented the two fluid primary cells which bear his name.

In about 1837 Professor S. F. B. Morse of Massachusetts introduced the telegraph, in which the attraction of an armature produced dots and dashes on a moving slip of paper.

In 1830 Maritz Herrman Jacobi constructed an electric motor which he used to propel a small boat on the river Neva. The source of power was primary batteries.

In 1845 Wheatstone and Cooke patented the use of electro-magnets instead of permanent magnets for dynamo electric machines.

In 1845 Faraday found that a polarized ray of light is affected by a magnet, thus establishing experimentally the electro-magnetic character of light, and as he expressed it, that magnetic force and light have relation to each other.

In 1848 Jacob Brett suggested the principle of the self exciting dynamo.

In 1851 Faraday discussed and defined lines of magnetic force; also expressed the opinion that the term "line of force" should be used to express not only the direction of the magnetic force, but also the quantity (which it now does).

In 1856 C. W. Siemens patented the famous shuttle wound armature invented by Werner Siemens.

The modern storage battery dates back to 1860 when Gaston Planté produced spongy lead and lead oxide sheets by the action of currents. The positive plates in many of the storage batteries now made are of the Planté type.

In 1866 and 1867 the first self exciting machines were built by Siemens and Wheatstone. Siemens built a series machine and Wheatstone a shunt generator.

In 1870 Gramme produced a dynamo with a smooth core ring armature entirely and uniformly covered with wire connected to a commutator having a large number of commutator bars. This was a fairly good direct current machine.

COMMERCIAL EPOCH

About this time capitalists began to see the possibilities of the commercial applications of electricity and the science began developing so rapidly that it is almost impossible to follow it. Just a very brief synopsis of the important discoveries and inventions since 1873 will however be given.

The principle of transmitting power from one dynamo to another used as a motor was exhibited at the Vienna Exposition by Fontaine and Brequet in 1873. This exhibit marked the beginning of the commercial use of electricity.

In 1873 Wilde devised a practical type of separately excited alternating current dynamo.

In 1873 Professor Henry Rowland discovered the law of the magnetic circuit and made some discoveries regarding permeability.

In 1876 Professor Alexander Graham Bell invented the telephone. His crude form of telephone contained the fundamental principles of the present receiver. He exhibited it at the Centennial Exposition.

In 1878 Charles F. Brush introduced his open coil constant current dynamo for use on series arc lamp systems.

In 1879 Thomas A. Edison placed the incandescent lamp on a commercial basis, having produced a durable carbon filament operating in a vacuum.

In 1880 Thompson and Houston introduced their arc lighting dynamo.

Stephen D. Field and Thomas A. Edison constructed an electric locomotive and exhibited it in 1883. About this time Frank J. Sprague, then a midshipman in the United States navy, became very much interested in electric railway work. He is one of the most prominent of the pioneers in the movement.

In 1880 Nikola Tesla patented the induction motor. The patents were acquired by the Westinghouse company. Alternating current distribution at 2,000 volts came into use about this time.

In 1890 a transmission plant was installed at Telluride, Colorado, employing Westinghouse single phase alternators of 100 horsepower, the largest then made. The potential was 3,000 volts.

In 1895 X-rays or Roentgen rays were discovered, also many electro-chemical discoveries; also the beginning of extensive hydro-electric developments utilizing high tension, polyphase alternating current for transmission.

In 1900 a 25,000 volt, three phase transmission line was run from Apple River, Wisconsin, to St. Paul, Minnesota. Part of the line was of paper and rubber insulated cable, under ground.

In 1901 the Cooper-Hewitt mercury vapor lamp and the alternating current rectifier were brought out.

In 1902 the first wireless message was sent across the ocean.

In 1903 the Nernst lamp appeared. (Also marks the advent of Wright Brothers' flying machine.)

In 1904 the International Electrical Congress was held at St. Louis. In 1905, the tantalum and other high efficiency lamps were introduced. In 1906, the New York Central direct current electric locomotives were put into regular service. In 1907, tungsten incandescent lamps were in general use; also New York, New Haven and Hartford alternating current single phase locomotives were placed in service. Flaming and magnetite arc lamps were produced. In 1908, the Great Northern three phase electric locomotives were placed in service in the Cascade tunnel. In 1909, wireless telephony became successful for some distance. In 1910, the Pennsylvania direct current locomotives with side rods and with the motors mounted on a deck were used. In 1911, wire type tungsten and incandescent lamps, giving 20 candlepower for 25 watts were produced, creating a new era in the electric lighting industry.

In 1912, at least ten 110,000 volt transmission lines were in successful operation, and both the Westinghouse company and the General Electric company announced their successful construction of 60 cycle, 500,000 volt transformers. One of the above companies is building a 1,000,000 volt transformer. The Allis-Chalmers Company, of Milwaukee, Wisconsin, is building transformers for the Nevada-California Power Company's 150,000 volt transmission line. The transformers are rated at 87,000 volts and three of them are to be connected in star to give a line pressure of 150,000 volts.

The Usherless Theater

By THERON P. FOOTE

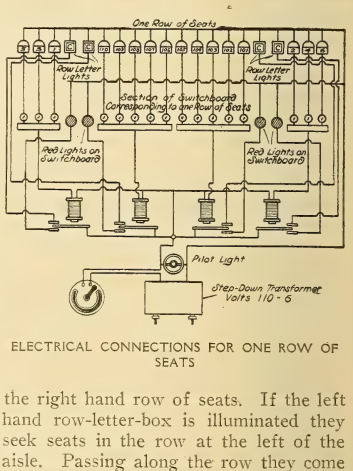
Ushering is an expense every theater manager would like to avoid. But it has always been assumed, and perhaps rightly, that the theater patron is not competent to find his own seat even when the section, row and seat numbers are plainly written on the cardboard stub which is torn from his ticket and handed to him as he enters the door. Indeed, scarcely anyone is prepared to take the initiative in this matter and we all invariably wait until the usher has shown us clear to the right row, and then, even, if he fails to turn down the seat itself we are more or less "up in the air" and are apt to ask several excited questions before we finally are placed.

All this is largely a matter of education. We have been taught by the theaters that in this one place, at least, we are not capable of looking for ourselves, and we have grown to believe it.

But now that there are automatic photographing machines, automatic restaurants, automatic telephones and automatic this, that and the other, perhaps people have arrived at a state which would permit them to take readily to an automatic, or rather an usherless, seating arrangement in a theater and one is here presented which would work if patrons would become familiar with it and "keep their heads." A wiring system for this purpose, although a considerable expense when the theater is built, would, by saving usher service, be able to pay for itself.

Cables of wires are laid from each row of seats on the main floor and balconies back to a booth under the vestibule. Directly over this booth in the main vestibule is a switchboard laid flat in the form of a table, the sides being all boarded in to enclose switches and wires running to the booth below.

To illustrate the operation of the equipment suppose a party of three to enter. The ticket taker at the door calls out as he tears off the seat stubs, "Right aisle—parquet—C 101-2 and 3." The man at the switchboard, which is near the ticket taker, presses buttons corresponding to the seats called for. The persons pass down the right aisle until they reach a row of seats at the end of which is a small illuminated box having glass faces on which is the letter "C." If this row-letter-box is on the right of the aisle they give attention to



ELECTRICAL CONNECTIONS FOR ONE ROW OF SEATS

the right hand row of seats. If the left hand row-letter-box is illuminated they seek seats in the row at the left of the aisle. Passing along the row they come to seats on the backs of which small lamps are burning. Upon sitting down these lamps go out as does also the row-letter-box lamp. The man at the switchboard has nothing to do with turning out the lamps—this is done by the turning down of the seats—he merely turns on the lights for each seat called. In large theaters when the rush is on two men might preside at the switchboard or even three and still there would be a saving of a dozen or fifteen ushers.

Seats can be provided such that electrical connections can be made at a bolt from each of the two legs under the floor. The embedded lamp on the back of the seat is wired in series with the seat switch so that the lamp burns when the seat is up and the operator at the switchboard has turned the proper switch but goes out when the seat is down.

Referring to the diagram, the light circuit enters the underground booth and passes through a step-down transformer. One side of the low voltage line connects in common one side of every seat in the house. The other low voltage wire is common to one side of every magnet in the controlling apparatus of the row-letter-box lights. From the remaining side of each seat a wire is run to the switch on the switchboard corresponding to the seat number.

Suppose there are sixteen seats in the first row; three on the left of the left aisle, three on the right of the right aisle and ten between the two aisles. Four row-letter-boxes will be needed, two in each aisle. Divide the switches corresponding to the ten seats which are between the two aisles into two sets, five in each set, and place a common contact or busbar under each set thus making four busbars needed for each row. Each busbar is connected with a magnet in the booth below. The armatures under the magnets control the row-letter-box lights. From the top contact of the armature under the magnet which is connected from the busbar corresponding with the three seats on the left of the left aisle runs a wire connecting the remaining side of the row-letter-box light on the left of the left aisle. When a switch, corresponding to a seat on the left of the left aisle in the first row is pressed current passes from one side of the transformer through the seat switch (if the seat is up) and lamp on the back of the seat, back through the switch which was pressed on the switchboard through the busbar and through the magnet which controls the row-letter-box on the left of the left aisle back to the transformer.

The current passing through the magnet draws the armature to the top contact and current then passes from one side of the transformer through the armature and top contact to the light in the row-letter-box and then back to the transformer.

As soon as the seat is pushed down the first circuit is broken, putting out the light on the back of the seat and cutting off current entering the magnet, which drops its armature and breaks the row-letter-box light.

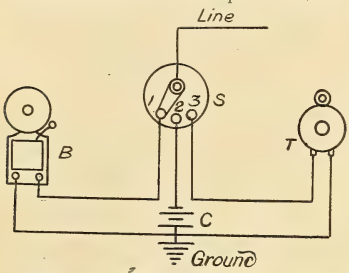
Should more than one seat switch be pushed down, all seats corresponding to switches must be down to cut out the circuit from the magnet which releases the light in the row-letter-box.

On the main switchboard miniature lights, preferably red, may be embedded, occupying the positions of the row-letter-boxes. One side of these lights may connect to the transformer and with the lower contact of the armature which works from the magnet in control of the corresponding row-letter-box light. Then on the switchboard, all red lights being on, when a switch button is pushed the light on the back of the seat corresponding to the button goes on, the light in the row-letter-box situated nearest the seat goes on and the red light on the switchboard goes out. As soon as the seat is pushed down, the seat light goes out, the row-letter-box light goes out and the red light corresponding to the row-letter-box goes on.

Simple Telephone System

The following is a description of a simple and cheap telephone system, which will operate successfully up to a distance of one mile. Its use will be convenient between house and garage, house and shop or for similar short distances.

In the diagram, (S) represents a three point wooden base switch, (B) a door bell, (T) a pocket telephone receiver, and (C) one or two cells of battery. The diagram represents a complete set of instruments such as are required at each



CONNECTIONS FOR SIMPLE TELEPHONE SYSTEM

station. The system requires but a single line wire, the gas or water pipe being used as the ground return.

The normal position for the switch is on point (1). To call up, move switch to point (2), letting it stay there a short time. Then move it to point (3), and take up the telephone receiver. While the switch is on point (2) the bell of the party called is ringing. To answer, the party called moves his switch to point (3) thus completing the talking circuit. When through talking both switches must be returned to point (1). The telephone receiver is used both to talk into and for listening. This may readily be accomplished by placing it in front of the mouth to talk, and moving it to the ear to hear the reply.

This system may be extended to three or more stations by using a definite number of rings for the call of each station. The number of cells of battery required depends upon the length of the line. Two cells will generally be sufficient. The total cost of apparatus for one station, without the battery is about one dollar.—J. W. Bacon.

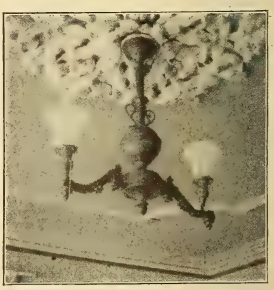
Converting Gas Fixtures to Electric

Some time ago the gas works in this village went out of business and the users of gas permanently abandoned the use of the system and adopted electricity for lighting purposes.

As a wiring contractor, I have very often talked with customers who said, "Why can't I use my old gas chandeliers?" They argued that their gas fixtures were in perfectly good condition and thought they could be used just as well for electricity as for gas.

As a consequence, I have sometimes wired these gas fixtures and the result has always been satisfactory.

The accompanying illustration shows one I fixed recently and a glance is convincing of the practicability of it. I drilled holes in the pipe for the entrance and outlet of the wires; added an in-



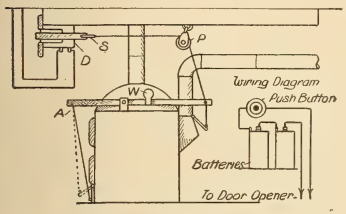
GAS FIXTURE CONVERTED TO ELECTRIC

sulating joint; put one-eighth inch sockets on the same nipples the gas burners were on; pushed in the fixture wires; connected them precisely as if it were an electric fixture direct from the shop; assembled, and the thing was done, ready to pass inspection.—M. S. Loke.

Control for Steam Heating System

In houses heated by individual steam heaters the temperature of the buildings is quite low about six or seven o'clock in the morning of a winter's day, and some little time must elapse after the drafts are turned on before the pipes and radiators become filled with steam.

Persons of an electrical or mechanical turn of mind need have no more discomfort on this account. The arrangement shown in the drawing will turn on the drafts and insure a warm house when the occupant is ready to get out of bed.



CONTROL ARRANGEMENT FOR HEATING SYSTEM

The device consists of an electric door opener (D), such as is used in apartment buildings for opening the main entrance door. This is secured to a beam or to the cellar ceiling near the heater. A strip of heavy metal (S) is bent in the form of a hook and this engages the movable member of the door opener. A length of picture wire is fastened to the end of the hook and passes over a pulley (P), connecting to the arm (A), which controls the movements of the drafts.

At night the hook (S) is drawn over and engages the door opener, thereby lifting the back draft and closing the one in front of the heater.

When the alarm clock rings in the morning it is merely necessary to press a button located near the bed, after turning off the alarm clock, and the door opener releases the hook, which in turn operates the drafts which are moved by the weight of the ball (W). The door opener should be released about 45 minutes before rising time.

The wiring diagram shows the method of connection, two or three dry cells being used to actuate the door opener.

This arrangement can be applied to any type of heater. The writer has had it in use for some time with considerable satisfaction.—A. B. Cole.

The Tree System

In the early days of electric lighting, the "tree" system was the common method upon which electric wiring and distribution were carried out. In the tree system, branch circuits are tapped from the trunk mains, and small branches are tapped from the main branches, hence the name "tree" system.

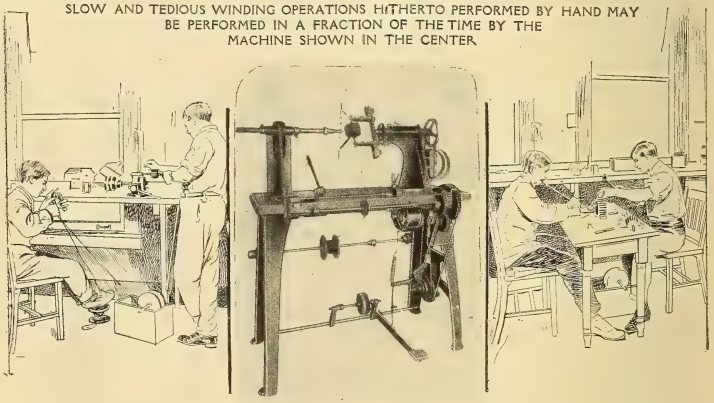
Nowadays, a branch is known technically as that portion of the circuit where the section of the conductor is reduced. Hence, if a conductor is reduced in a straight run, the reduced portion is a branch, just as much as if it had been tapped or branched off the trunk main. A tapping, however, is not technically a branch if the size of conductor is the same as that from which it is tapped; the reason for this distinction being that, according to modern wiring rules, every "branch" must be protected by a fuse. The "tree" system is still used for the distributing networks of public supply systems, also for collieries, exhibitions, and scattered installations of a like character, but is practically obsolete for interior wiring. The objections to the system are: That the pressure on the lamps is not uniform; that, with a varying number of lamps in circuit, the pressure cannot be maintained even approximately constant at the lamp terminals; that a fault on the system is difficult to localize, and that a short circuit on a branch may cause a main fuse to blow."—Frank Broadbent.

Coil Winder

In shops where coils are wound for armatures, fields, heating elements and the like, the work must be done by hand. —a slow process—or else special machines must be constructed to fit each particular class of work. An almost human machine that will wind wires on almost any electrical device manufactured, as represented by the International winder, will immediately interest any one having this class of work to do. There is all the difference in the world between winding a drum armature and a ring armature. Yet so flexible is the machine that in a few moments it may be adjusted to do either. In addition it winds solenoid coils, transformer fields and induction coils; even more, it embodies an adjustable coil form, a very simple device which, attached to the winder, actually forms up the coils, after they are wound, to any desired shape.

The work when done is neater and more accurate than hand work and in many cases it can be accomplished in one-tenth the time. A small motor of one-eighth horsepower suffices to operate the machine.

SLOW AND TEDIOUS WINDING OPERATIONS HITHERTO PERFORMED BY HAND MAY BE PERFORMED IN A FRACTION OF THE TIME BY THE MACHINE SHOWN IN THE CENTER

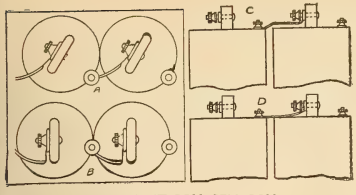


Boxing and Connecting Dry Cells

It is sometimes desired to place dry cells in a battery box and in many instances when this is done the cells are not properly arranged and are also crowded too tightly against one another, says *Telephony*.

In the diagram (A) shows the right and (B) the wrong way of placing cells when connecting them in series in the box. As placed in (B), the binding post on the zinc of one cell comes in contact with the neighboring cell. If through jarring or jostling the paper jacket of the latter cell is worn through at the point of contact, this cell will be subjected to a dead short circuit and ruined. Short circuits are much less likely to occur if the cells are placed with the positive and negative terminals out of line as in (A).

Insulated connectors or wires should always be used for connecting cells to form a battery. (D) illustrates a condition which often exists when bare wires are used for this purpose. Initially, as shown in (C), the connecting wire is carefully raised above the zinc can. However, through accident the wire may



CONVENIENT DRY CELL BOX

be depressed until it touches the rim of the zinc, in which case the cell indicated is short circuited.

Motor and Brake Attachment for Sewing Machines

The following is a description of an electric motor and brake attachment for an ordinary sewing machine. The accompanying drawings show the details and general arrangement of this attachment.

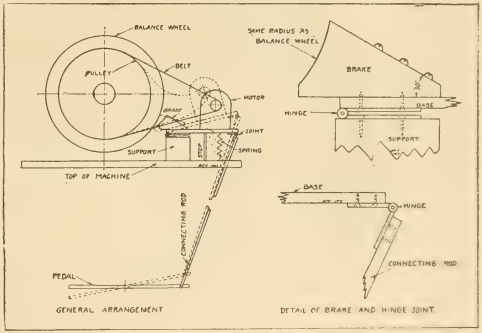
The machine can be brought to an instant stop by simply pressing on the foot pedals, which loosens the belt and applies the brake simultaneously.

In the drawing showing the general arrangement, the small motor base is fastened to the wooden support with a strong, wide, brass, spring hinge. A stop is placed so as to prevent the base from falling too low. The brake is screwed to the base and placed so as to clear the balance wheel by ¼ inch. Screw down the motor and place the belt in position.

The old connecting rod is replaced by a longer one which fastens to the motor base with a small hinge. See details. The tension hinge may be used if no large spring hinge takes the place of a plain strap hinge.

Pressure on the foot pedal is transmitted by the connecting rod to the motor base, which raises the motor base and throws the motor forward, thus loosening the belt and applying the brake. The motor can then run free or be shut off with a switch that is placed in a convenient place.

In the general arrangement the full lines show the running position and the dotted lines show the position when the pedal is pressed.



SEWING MACHINE MOTOR AND BRAKE

Colored Lacquer for Lamp Globes

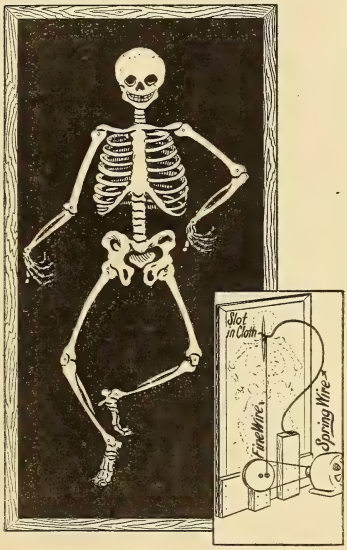
One of the great difficulties that has been experienced with lamp lacquer in the past has been due to the checking and cracking resulting from the expansion and contraction of the glass. A new lamp lacquer which has the same coefficient of expansion as the bulb itself, thus eliminating this very disagreeable trouble, has been put upon the market under the name—Mazda Weatherproof Lamp Lacquer. Another special feature of this product is the fact that the colors positively will not fade.

The cost of applying this coloring to the lamp is reasonable and the color effects that can be secured are excellent. It is furnished in six standard colors; amber, canary, red, blue, green and

white. These colors are remarkably brilliant and any number of tones may be procured by blending the different standard colors.

The Mysterious Skeleton

A mysterious skeleton that dances everything from the "Highland Fling" to the "Grizzly Bear" was the unique and clever attraction which drew much attention to a store window in a Pacific Coast city.



DANCES EVERYTHING FROM THE HIGHLAND FLING TO THE GRIZZLY BEAR

A large frame was covered with black cloth and against this was hung a skeleton made of cardboard, fastened together with wire at all the joints. Behind the frame was the mechanism which caused the skeleton to dance so gleefully.

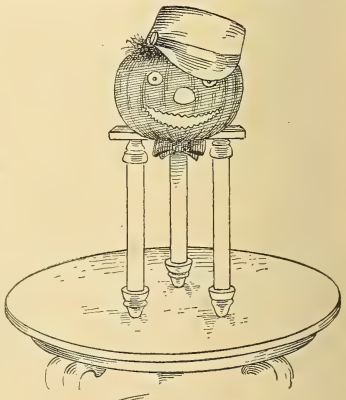
The skeleton was hung on a long spring wire which protruded through a slot in the black cloth just behind the head. This slot was not visible from the front. From the top of the spring wire was run a small wire to a wooden wheel below, which was about eight inches in diameter. The wheel was turned with a belt by a small motor. The smaller picture shows the construction from the rear.—H. O. Bunnell.

The Talking Pumpkin

The illustration shows a figure which attracted considerable attention at a recent electrical exhibition. It consisted of a life-size imitation jack-o'-lantern mounted on three large glass pillars cemented at either end to brown porcelain high tension insulators.

At specified times during the day the pumpkin would break the silence and answer questions and crack jokes with the mystified spectators who invariably gathered around his enclosure.

The secret of the device lay in an especially designed dictaphone placed inside the hollow head and connected to a distant operator by concealed wires. Fine, tightly drawn conductors passed in vertical lines through tiny holes in the insulators and pillars and concealed grooves in the table legs to the floor below.



THE TALKING PUMPKIN

Electrical Securities

By "CONTANGO"

The Balance Sheet and What It Means — Assets

In studying any corporation security the balance sheet is the first exhibit to which attention should be given. Briefly, the balance sheet is a statement which shows the financial condition of a given company at a given date, usually the last day of the particular company's fiscal year. It is a showing of assets and liabilities—in other words a statement of what the company owns and what it owes.

Broadly speaking there are three kinds of assets and three kinds of liabilities, usually described as follows: capital assets, current or quick assets and deferred assets; capital liabilities, current liabilities and deferred liabilities.

CAPITAL ASSETS

Capital assets, or, to give them another name which explains itself, "fixed" assets, consist of the things which go to make up the physical property necessary to the everyday running of the business and other things acquired for purposes of more or less permanent investment.

Property Account.—Under this head come naturally the company's plants and equipment or machinery, its real estate, buildings and the like. Usually these items and the amount they represent are set down in the balance sheet without further explanation. In such cases the amounts may be presumed to represent the actual cost of the properties. If, however, the item reads "Value of" real estate, plants, etc., the basis of the valuation should be ascertained as well as the experience and general character of the appraisers responsible for the value placed on the property.

Intangible Assets.—In the accounts of industrial companies, usually under the caption "Capital Assets," is frequently found a sum represented by good will, patents, trade marks, etc.

This may or may not represent fictitious value, for in trade a thing is of value when it commands a price. The fact must not be lost sight of, however, that many substantial going concerns do place a value on good will, etc., and capitalize it. But the investor in such cases should take carefully into consideration the personnel of the management and the soundness of the organization in all particulars.

Some of the well established companies do not attempt to figure in such things as among their assets. For example a great electrical manufacturing company of this country and England, with all its vast business good will and undoubtedly valuable patents, etc., sets their value at just one dollar. For the reason that such assets are spoken of as intangible, it therefore goes without saying that a company whose intangible assets form the larger part of its total assets is not put together as it should be. Other assets more or less intangible, and which should be inquired into carefully to determine their real value, are sometimes shown as organization expense, charter, leases, licenses, contracts and the like.

On the other hand under the head of "Capital Assets" there would legitimately come any securities represented by stocks and bonds in other corporations.

If a company has large security holdings outside its own as compared with its other assets, the character of such holdings should be looked into and their yield as to dividends and interest in relation to the price paid for them when purchased. It has happened that the failure of such companies has in the past proved the undoing of the big concerns holding their securities. Default of interest or failure to pay dividends on securities owned by

one corporation as investments in another is a serious matter. It does not, however, concern so much the electrical system of financing, as in the main this is a matter of holding, and therefore guaranteeing, companies directly responsible for subsidiary companies.

QUICK ASSETS

These include bills receivable and accounts receivable, cash on hand and in bank and any property such as stocks of merchandise which might be turned into cash at short notice, always excepting permanent assets forming part of the "Capital Assets." As a general proposition public utility companies do a cash business, so there is not much to be written off or placed on the liability side of the balance sheet under the definition of "bad debts." But in considering these quick assets such items as advances to subsidiary companies must not be considered, for they may or may not be paid promptly.

Materials and supplies might be considered under this head and usually are, but it would be well to ascertain how they have been rated, whether at the current market value, if that is less than what they cost, or at cost if the cost was less than the market value at the time of issuing the balance sheet. Moreover, if the material is of a speculative character so far as price is concerned, as for example copper, low quotations should be considered when determining their value.

No stocks or bonds may be considered in quick assets except those purchased temporarily for the purpose of using idle funds, but even should the amount warrant their being classed as permanent investments then the same principle as to valuation applies as to materials and supplies—their worth must be considered in the light of market quotations, and if, since the time they were purchased, there has been an advance in price, then wide allowance must be made for a decline. This is merely conservative financing.

DEFERRED ASSETS

This term is used to express an asset which is neither quick nor capital. It is usually meant to apply to advances made to subsidiary companies and other outlays of money of a like character, such as money put out in construction or advanced for taxes, etc. The value depends on the purpose, and, in the case of money spent on subsidiary companies, the strength or lack of strength of these subsidiary companies. But without looking upon this as a separate line of investigation it may be suggested that "Deferred Assets" must be considered to represent a very certain actual value to be considered assets at all. Interest charges for subsidiary companies before they have been properly developed sometimes come under this head.

Treasury stock or bonds can never really be considered as quick assets. By this term is meant amounts of stocks or bonds authorized but never sold, or which may have been purchased by the company itself and made a part of its sinking fund. The change in price whether up or down certainly prevents their being placed in the category of "Quick Assets." This will give a fairly comprehensive idea as to what may be considered a corporation's assets, taking them by and large, as the saying is. In a subsequent issue it will be the purpose to throw an equal amount of light, and more if possible, on "Liabilities" in all their aspects. After that the source of a company's revenue or income, that is, its earning power, will be dealt with and considered in detail from the investor's standpoint.

(To be continued.)

List of Selected Bonds showing Income Yield

Under the above heading, from month to month, a list of carefully selected securities will be given showing the approximate income yield. In this connection it is to be remembered that the income yield depends upon the price that is paid for the bond, and, as in the case of commodities, bond prices fluctuate according to the laws of supply and demand and to the quality or worth of the security in the opinion of the buying public. For instance, if a bond of a face value of $1,000 and paying six per cent interest can be bought in the market at 98, or, in other words, for $980, the income yield to the purchaser will not be six per cent but a little over 6.1 per cent. That is, a year's interest on the bond is $60. If it is bought for $980, the income will be $60÷980=6.1 per cent. Correspondingly, if the bond is bought above par, say 102, the income yield in that case will be $60÷1020=5.88 per cent.

In compiling the list below, the income yields given are perforce those determined by the market prices of the bonds at the time of writing, which is somewhat earlier than the date at which the magazine reaches its readers. But as the market price on stable securities such as these fluctuates very little the table is sufficiently accurate to enable the prospective purchaser to make his selection intelligently.

Bonds to Yield From 4.70% to 6.00%

New York & Westchester Lighting Co. General 4% bonds. Mature 2004. Yield about 4.70

Scranton Electric Co. First and refunding 5% bonds. Mature 1913–37. Yield about 4.78

Watertown (N. Y.) Light & Power Co. First 50-year gold 5% bonds. Mature 1959. Yield about 5.00

Western United Gas & Electric Co. First and refunding 5% bonds. Mature 1915–50. Yield about 5.00

Binghamton Light, Heat & Power Co. First 5% bonds. Mature 1942. Yield about 5.00

Port Huron Light & Power Co. First 5% bonds. Mature 1911–21. Yield about 5.00

Rockland Light & Power Co. First 5% bonds. Mature 1938. Yield about 5.03

Central Main Power Co. First 5% bonds. Mature 1939. Yield about 5.07

Claremont Power Co. First 5% bonds. Mature 1937. Yield about 5.10

Kankakee Gas & Electric Co. First and refunding 5% bonds. Mature 1930. Yield about 5.10

Chattanooga Ry. & Light Co. First and refunding 5% bonds. Mature 1956. Yield about 5.22

Illinois Northern Utilities Co. First and refunding 5% bonds. Mature 1957. Yield about 5.30

Indiana Railways & Light Co. First and refunding 5% bonds. Mature 1943. Yield about 5.40

Jackson Light & Traction Co. First 5% bonds. Mature 1922. Yield about 5.55

Brandon Gas & Power Co. First 6% bonds. Mature 1929. Yield about 5.70

Central States Electric Corp. 5% notes. Mature 1922. Yield about 5.75

Parsons (Kansas) Water Supply & Power Co. First 6% bonds. Mature 1922. Yield about 6.00

Carolina Power & Light Co., Raleigh, N. C. First gold 5% bonds. Mature 1938. ($500.) Yield about 5.60

Central States Electric Corporation, Cleveland, O. 5% secured gold notes. Mature 1922. ($500.) Yield about 5.75

Consumers Power Co. of Minnesota, Chicago, Ill. First mortgage 5% gold bonds. Mature 1929. ($500.) Yield about 5.75

Pacific Gas & Electric Company, San Francisco, Cal. General and refunding 5% bonds. Mature 1942. ($1,000.) Yield about 5.50

Pacific Gas & Electric Co., Phoenix, Ariz. Sinking fund gold 6% bonds. Mature 1931. ($1,000.) Yield about 5.80

Tri-City Ry. & Lt. Co., Davenport, Ia. First refunding 5% gold bonds. Mature 1930. ($1,000.) Yield about 5.62

United Light & Railways Co., Chicago, Ill. First and refunding gold 5% bonds. Mature 1932. ($1,000.) Yield about 5.60

Western United Gas & Elec. Co. First and refunding 5% bonds. Mature 1950. Yield about 5.00

Searsport (Me.) Water Co. First 5% bonds. Mature 1927. Yield about 5.00

The Growth in the Earnings of the Electrical Companies

The chart shown herewith indicates the independence of electrical public utility corporations in periods of financial and business depressions, as compared with steam railways for example.

The chart shows that starting from 100 per cent in 1902 steam railway gross earnings held a slight upward trend until 1905; but in 1905 gross earnings rose to above 134. The best point was reached in 1907 when 148 per cent was reached. The panic of that year, however, quickly sent it down again. In the period since 1907 until 1911 there was a slight advance. Net earnings in the same periods

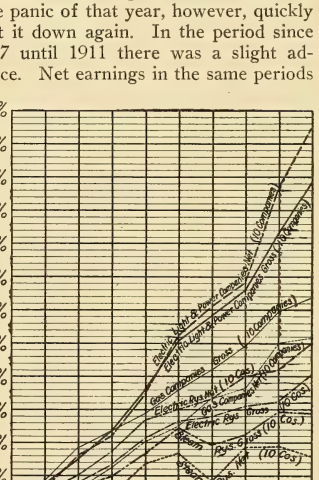


CHART SHOWING INDEPENDENCE OF ELECTRICAL SECURITIES IN PERIODS OF FINANCIAL DEPRESSION

did worse, dropping to seventeen points lower in the panic.

Now contrast this with the movement of electric light and power companies. In this nine-year period they made the best net and gross earnings showing of all, advancing very rapidly without interruption during the periods of depression to the high point of 328 per cent for net earnings and 296 per cent for gross at the beginning of the year 1911.

Electric railways showed a gross earnings advance of from 100 in 1902 to 156 at the end of the panic year of 1907. The panic in this case merely meant a slower movement upward from that time on to 1910, after which the advance was very rapid.

And in connection with this the following table of prices for some of the leading public utility shares during 1912 is most remarkable. The table gives the prices bid and asked at the opening of the year, the high and low price for the year, and the prices bid and asked at the end of 1912:

	Jan. 1, 1912,	Dec. 28, 1912,	High	Low
Am. Light & Trac	294 –297	400 –410	447	294
Preferred	106½–108½	108 –110	113	105
Am. Gas & Elec	65 – 67	81 – 85	95	65
Preferred	43¾–44¾	46 – 47	51¼	43
Am. Power & Lt	71½– 74	66 – 69	78	65
Preferred	82 – 83	83 – 85	88	82
Cities Service	81¼– 82	110 –113	125	81½
Preferred	81¼– 82¼	86 – 88	93¾	81¼
Cmnwlth P., Ry. & Lt	57 – 59	64 – 66	71	57
Preferred	89 – 91	88 – 90	93	87
Elec. Bond Deposit pf	.. – ..	76 – 78	83	75¼
Federal Lt. & Trac	38 – 42	33 – 37	45½	31
Preferred	78 – 80	83 – 86	85½	77
Gas & Elec. Sec	99 –103	135 –145	165	98
Preferred	87 – 90	92 – 96	98	88
Lincoln Gas & Elec	29½– 32	32 – 36	44	29
North. States Power	30 – 33	22 – 25	38	23
Preferred	89½– 91	84 – 86	92¼	85
Ozark Power & Water	.. – ..	47 – 50	51½	45
Pacific Gas & Elec	54 – 55	62 – 63	71	53
Preferred	89 – 91	90 – 92	95	88½
Republic Ry. & Lt	27 – 29	25 – 27	31½	25
Preferred	77 – 79	79 – 81	83½	76
Standard G. & E	22 – 25	20 – 22	25	20
Preferred	48 – 49	50 – 51	53½	47½
Utilities Impt	.. – ..	60½– 62	69	60½
Preferred	.. – ..	75½– 77½	80	75½
United Lt. & Rys	58 – 60	78 – 80	81½	57
Un. Lt. & Rys. 1st pf	86 – 88	82 – 84	87½	82
Un. Lt. & Rys. 2d pf	69 – 71	72 – 75	77	72
Western Power	28 – 31	25 – 27	34	25
Preferred	55½– 60	51 – 53	62	50

It may be noted also that the chart plotted on a basis of percentage of earnings for the years 1902 to 1910, covers two periods of financial depression, but in spite of this fact earnings of electric light and power companies have increased over 200 per cent, earnings of gas companies over 100 per cent and earnings of electric railways over 80 per cent in the decade. In not a single year, the chart shows, was there any period of decreased earnings for these public utility companies.

SCIENCE EXTRACTS FROM FOREIGN JOURNALS

A Municipal Kitchen.—An electric cooking plant on a large scale has been installed by the municipality of Marleybone Lane, and it is without doubt the largest in England. It is used to provide food as well as tea for the 1,000 employes of the administration. The supply of the provisions is made by contract with an outside company, and since the great electric kitchens have been in operation they are already giving remarkable results and are claimed to be as economical as gas or coal. In the main kitchen are seven electric stoves of large size, also two smaller ones, besides large dressers which use hot air from the stoves to heat them up. The dining room is well fitted out with a heating table divided into six cells so as to keep the food hot until the employes come in, then they serve themselves from the hot tables. In the adjoining room are two heating dressers fitted up so that the top serves as a flat surface for carving meat; also three large teapots each holding five gallons. The kitchen also has two electric water boilers whose steam goes to these pots so that 500 pounds of potatoes can be boiled per hour. Next to these are electric cookers and ovens for meat, puddings and vegetables. Electric broilers are also used here. The present plant is fitted out by the British Prometheus firm.—*Revue Électrique, Paris.*

Doctor's Portable Power Plant.—An English physician, Dr. Gamlen of West Hartlepool, is using his automobile so as to run a small electric plant with the motor and thus secure a supply of current for electro-medical purposes, especially for X-ray apparatus. He fitted up the new device according to his own plans. When he wishes to set up the plant, the back wheel of the car is jacked from the ground and taken off, and in its place is fitted on a spare wheel which has no tire and acts as a pulley. Coupled by a short belt to this pulley is a dynamo of small size, this being held on a table or shelf base carried on the car. When setting up, the table is attached to the rear end of the automobile in the proper way and the belt is easily slipped onto the dynamo pulley and the car wheel. Thus the dynamo is run by the power of the car, and the whole device is easily set up. Cables can be run from the automobile when it is stopped outside of the patient's house, and the current is run into the house and used for working the portable X-ray or other electro-medical apparatus which the doctor brings with him.—*Autocar.*

Electric Tanning Process.—Dr. A. Groth, a Swedish engineer, is engaged in applying an electric tanning method in England and it is attracting quite a little attention on account of the good results which are obtained. He is able to carry out the tanning in the best way by placing the hides in a bath in which electric current is flowing and this he is now demonstrating on a practical scale in the tanneries operated by Mr. C. Smith at Kidderminster, Worcestershire. The process is quite a new one and is said to give a perfect and solid tanning in six weeks time and often less, while it is well known that the usual tanning process takes several months to carry out. Besides, the quality of the leather appears to be better. Different kinds of controlling apparatus serve to regulate the current in the baths so as to make the method an automatic one during the whole tanning operation and a set of electric safety devices keep the current from rising high enough to do any damage. The whole plant can be looked after by two boys, so that there is a saving of labor, and on the whole the cost is lower than before. Any bad

working is signaled by bells and lamps, so that the proper point can be inspected. It is said that the well known electrical firm of Walder Bros. & Thomson are to take up the method on a large scale. —*l'Electricien, Paris.*

Bell System Proof Against Fire-damp.—A somewhat novel telephone method is being used on the Continent for mines where fire-damp occurs, and the object is to avoid all sparks that would be likely to explode the gas. Before this there were used telephones and bells mounted in tight boxes for keeping out the gas, but it appears that the gas still leaks in quite frequently so that some better method is to be looked for. As an explosion of the mine gas might lead to a very serious trouble, the matter is one which is worthy of the attention of inventors. M. C. Feder claims to have solved the problem by the use of an electric bell which works on alternating current, so that the magnet and clapper will vibrate without needing any break of the current, and no spark can occur in this way. At the other end of the line is mounted a magneto of novel design and in it the permanent magnets rotate and the armature with its coils is fixed. The wires come directly off the armature so that there is no slide contact and therefore no spark, and the usual commutator is suppressed. As to the telephone transmitter itself, it is found that the microphone does not produce dangerous sparks.—*Genie Civil, Paris.*

Huge African Power Project Near Completion—In the South African region there is being erected a large hydraulic plant by the Victoria Falls and Transvaal Power Company. It is located on the Vaal River at Vereenigung and will distribute current to quite a distance. The power house will have four large turbine and alternator groups of 15,000 to 25,000 horsepower size. This electric station lies some 35 miles south of the Rand, and the site was chosen on account of the hydraulic power which the river affords here, and besides there can be had a good supply of coal as an accessory to the water power. A long power line will bring the current up to the Rand. The wires for the 80,000 volt line are hung by suspension insulators from lofty steel towers using a very long span of 480 feet on the average. At present the work upon the line is well advanced and it will be completed before long. The line comes into the Robinson Central Deep transformer station, and here has been set up a new 80,000 volt transformer, so that the voltage is lowered and the current will be distributed from this point to the districts where it is needed.—*North African Journal.*

Gasoline-Electric Motor Cars.—The new Tilling-Stevens gasoline-electric motor bus is meeting with considerable success in London and other cities of England. While working on the usual lines of this system, that is, using the gasoline motor of the automobile to drive a small dynamo so as to give current for motors on the car wheels, there are a number of improvements which account for the good working of the new bus. Since it was first introduced some four years ago, the method proved excellent for heavy duty such as is required of the passenger bus in large cities. In London there are 200 busses of the kind in use or in construction, and no doubt this number will be increased as time goes on. In other parts of England a number of companies are adopting it for running motor bus lines in connection with the tramways. Quite lately there has been designed a 40 horsepower motor bus which will come into good use in mounting heavy grades in the hilly districts, and already a number of busses of this kind are being supplied for use in the city of Liverpool. These new cars weigh only 350 pounds more than the standard 30 horsepower bus which is now used in the London service. —*Engineering, London.*

New Galvanizing Process.—Iron objects are protected from rusting by galvanizing in an electric bath or by dipping in melted zinc so as to give a thin coat of zinc, by the well known process, but the zinc does not always adhere to the iron so that the layer peels off in spots and leaves the iron so that it will rust in the air. The new German process brought out by Engineer Lohmann is said to avoid this drawback, and the zinc penetrates into the pores of the iron so that it holds on fast. After cleaning the iron in an acid bath to brighten it, he dips it in a mercury salt so as to decompose the solution and give a deposit of metallic mercury on the iron. In fact it is a familiar experiment to give a bright coating of mercury upon a copper coin or other metal piece by dipping or rubbing with mercury salt solution, and the same method is used here. Thus the mercury enters the pores of the iron and gives a deep amalgam. He then puts the piece in an electric bath of zinc solution at a high heat and leaves it for three minutes. The zinc drives out the mercury and takes its place in the pores of the metal, thus adhering very tightly to the iron, and the microscope shows in fact that the zinc penetrates well below the surface. Such a layer is not likely to come off, and the iron is well protected from the weather.—*Zeitschr. für Schwachstr.*

Moving Picture Machine for the Home.—Several of the Paris firms are occupied with designing a moving picture machine of very simple and practical kind for the use of amateurs, especially with the idea of having them used in homes as an attractive and also an instructive amusement. The use of the metallic filament lamp now affords a strong light which will throw a picture on a good-sized screen, so that this does away with the arc light, which is harder to manage. In this way, added to the design of a machine at low cost so as to bring it within reach of amateurs, the new machines are likely to be a success. An ingenious idea is now applied by the Pathé company in this connection. The current for the lamp is given by the machine itself, using a small dynamo which the operator works by the crank at the same time as the rest of the mechanism, and this makes the whole apparatus self contained and will be very useful in cases where the house is not wired up. A brilliant light is given by raising the voltage on the lamp much above the standard, and while this burns it out in time, the lamp lasts at least for eight or ten hours, and is cheaply replaced. Safety is increased by the use of non-combustible celluloid films.—*Genie Civil, Paris.*

NEW BOOKS

Practical Mathematics. By Claude I. Palmer. New York: McGraw-Hill Company. 1912. 176 pages with 31 illustrations. Price, Part III, 75 cents.

This book is the third of a series mentioned in the February issue, page 1125, and considers the subject of algebra and its applications.

Opera Stories. Boston: Henry L. Mason. 1911. 92 pages with 20 illustrations. Price, 50 cents.

Now that the talking motion pictures have arrived and will be placed before the public in a short time by two great booking companies, giving complete operas, there is increased need of such a book as this, which embodies short, concise stories of the great operas. The stories (divided into acts) tell of 132 operas and are embellished with fine portraits of the leading singers.

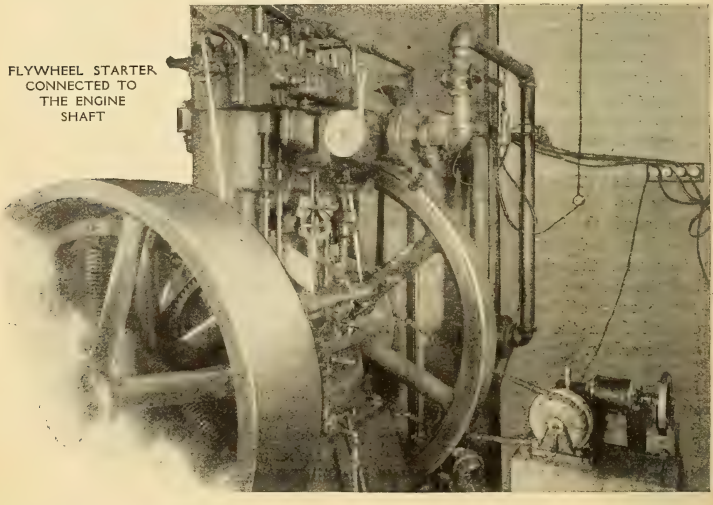
Wireless Telegraphy Simply Explained. By H. T. Davidge. New York: Spon and Chamberlain. 1912. 87 pages with 26 illustrations. Price, 25 cents.

A book in which wireless telegraphy is as simply explained as the number of pages and the technical nature of the subject will permit. A good book for the beginner or reader who wishes to obtain a general knowledge of the subject.

Flywheel Motor Starter

The starting of a gas engine, as everyone knows, requires the expenditure of a certain amount of mechanical energy; this for the reason that the combustible, together with the requisite amount of air, must be drawn into the cylinders and then compressed by the backward stroke of the piston before the charge can be exploded and start the engine to running of itself. This operation is most familiar in the laborious cranking of an automobile engine. In stationary engines, too large to crank by hand, the work is often done by a separate compressed air equipment, which is expensive and, if it fails to accomplish its purpose, puts it up to the engineer to try to start the engine by wrestling with the spokes of the flywheel, and taking a chance of being dashed through a cement floor or out through the roof, as the case may be.

Not long ago, an inventor, facing this problem in his own engine room, designed and patented the flywheel motor starter shown attached to the engine in the picture herewith.

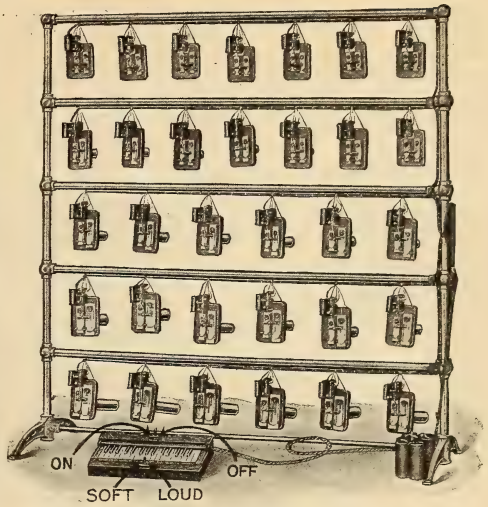


FLYWHEEL STARTER CONNECTED TO THE ENGINE SHAFT

It is a well known fact that a flywheel stores up a great amount of mechanical energy if it is made to revolve rapidly enough. This principle is applied in the starter. A small electric motor operated by a storage battery is designed so as to attain a speed of 8,000 revolu-

tions a minute inside of ten seconds. To the shaft of this motor is fastened a flywheel eight inches in diameter, and weighing eight pounds. When this tremendous speed is attained, even this small wheel possesses a great amount of energy. When the lever of the clutch is thrown over, this stored up energy is applied through a worm gear and the sprocket wheel and chain, to the shaft of the gas engine, and easily throws the engine over. In case the explosion should not occur properly at the first compression, there is sufficient energy in the little starter to keep the engine turning until the explosion does come, as the flywheel on the starter will store up enough energy for this purpose between compression points. When the engine is running, the lever of the clutch is thrown back and the starter disconnected.

The starter is also built to apply to automobile engines. In this case it is run from a storage battery on the car, this battery also serving for ignition and lighting purposes. Here the motor, of 1-3 horspower, is wound to attain a speed of 17,000 revolutions a minute without the five pound flywheel. With the latter connected it is 13,000 revolutions. This is said to be one of the speediest motors ever constructed for low voltage work. It may also be added that the energy stored up in this little five pound flywheel is equivalent to sixteen horse power for one second—enough, not only to start the engine, but even to start the car itself if the clutch were thrown in.



THE OCTOPHONE—A NEW CREATION IN ELECTRICAL MUSICAL INSTRUMENTS

The Octophone

One of the newest creations in the way of electrical musical instruments is the Octophone, operated from a keyboard. Each unit is self contained and consists of special alloy bars mounted upon a frame with resonators operated by electro-magnets which are controlled from the keyboard. The simple wiring is the same as in any ordinary annunciator or doorbell, the circuit being opened and closed by the pressure of the keys.

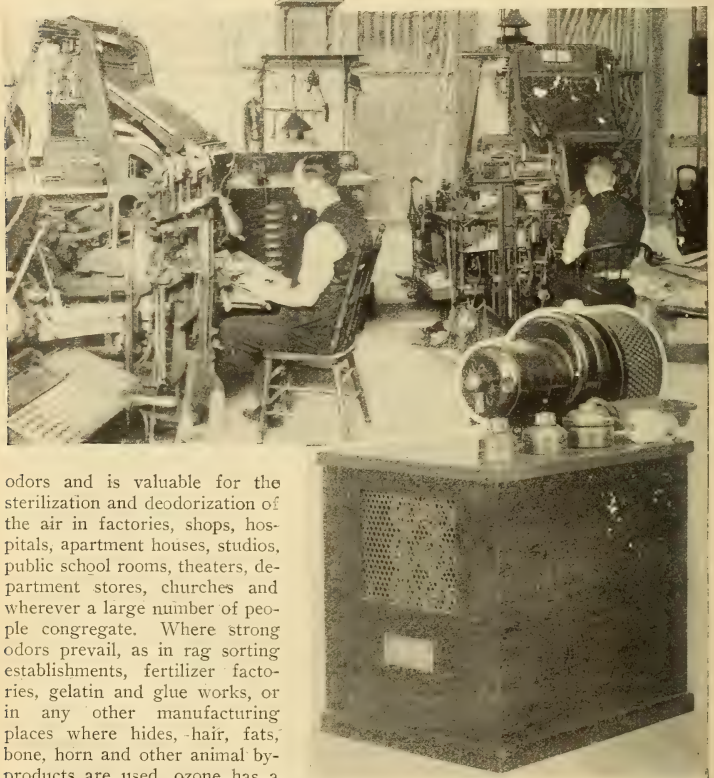
The Octophone is made in several styles, suitable for a theater or for automobiles, in which latter case the trunk containing the instrument can be attached to a running board and no amount of jarring will throw it out of order.

One of the advantages of electricity which seems to have been overlooked is that you can't commit suicide by inhaling it.

The Ozonator

Ozone purifies the air by "burning up" all animal refuse, waste products and bacteria which float in the air in large quantities in all crowded places. It destroys all odors and is valuable for the sterilization and deodorization of the air in factories, shops, hospitals, apartment houses, studios, public school rooms, theaters, department stores, churches and wherever a large number of people congregate. Where strong odors prevail, as in rag sorting establishments, fertilizer factories, gelatin and glue works, or in any other manufacturing places where hides, hair, fats, bone, horn and other animal by-products are used, ozone has a recognized commercial value. For many years the fumes arising from burning gas and molten type metal imperiled the lives of linotype operators. The application of ozone oxidizes and breaks down these poisonous gases.

In the new Ozonator, as is is called, an electrical discharge is caused to pass between electrified cylindrical surfaces between which air is drawn by means of a fan. When the intensity of the electrical charge on the surface of the plates reaches a certain value the electricity will discharge into the air in tiny streams and the energy thus imparted changes the oxygen of the air into another form known as ozone.



POISONOUS FUMES FROM BURNING GAS AND MOLTEN TYPE METAL ARE RENDERED INNOCUOUS BY OZONE

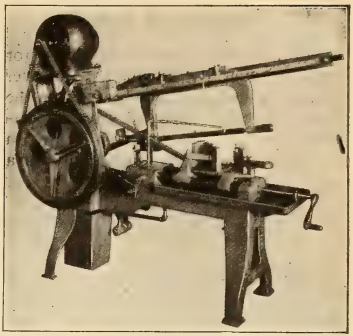
Each Ozonator embodies a step-up transformer which raises the supply voltage, sufficiently to bring about the discharge. The transformer is located in the base of the device and above it is the ozonizer proper, which consists of a bank of ozone generating units, each unit consisting of a cylindrical glass tube outside of which is a metallic coating. Inside of the glass tube is a metal electrode. This electrode is built up of shallow, perforated metal cups, mounted on a spindle, a small air gap existing between the cups and the bore of the tube. One high voltage lead from the transformer is connected to the outer coating of the glass tube and the other to the inner electrodes.

The charge of the outer coating of the glass is induced on the inside of the tubes and a violet electrical discharge takes place between the inside of the tubes and the inner electrodes. This discharge across the small air changes some of the oxygen of the air into ozone. The capacity of these machines can be readily increased by adding to the number of tubes.

The scientists tell us that ozone is a colorless gas with the odor of chlorine when present in small quantities and smelling of phosphorus in strong concentrations. It is one of the modifications of oxygen, with a chemical formula of O_3, formed by the absorption of energy, and in the presence of oxidizable organic substances it readily decomposes into oxygen while the third atom forms a more stable compound with the substance attacked.

Motor Driven Hack Saw

A motor driven hack saw is one of the latest additions to the machinery used in the metal industry. The Kwik-kut saw, contrary to the usual practice of having a fixed stroke of six inches, is arranged so that the length of the stroke is automatically regulated by the size of the stock held in the vise, this regulation



HACK SAW

providing for the use of as much of the blade as possible at each stroke. The saw is also lifted on the return (non-cutting) stroke, a saving of wear upon the blades. The machine stops automatically when the cut is finished. To avoid burning the blade, a pump, tank, pipes and catch basin are provided which keep the work lubricated. The motor which operates the saw rests on a special bracket and is connected to the machine by silent chain drive. A variation of from 50 to 100 strokes per minute is obtainable.

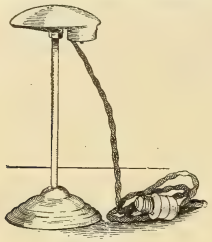
Telephone Slug Holder

TELEPHONE SLUG HOLDER

The Dandy telephone slug holder adds to its convenience by being fitted with clips which hold in place the names and telephone numbers of persons frequently called. The holder is finished with a coat of black enamel and is provided with screw holes for fastening.

Electric Puff Iron

Puff irons are used by milliners for treating plumes. By drawing a plume over the convex surface of the heated iron the plume is given a beautiful wavy appearance. The electric puff iron shown in the illustration was made especially for a



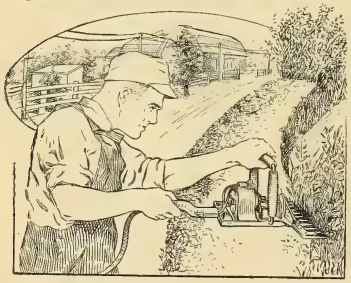
PUFF IRON

large millinery concern and is much superior to other forms; the heat is always uniform and the risk of burning the delicate plumes is reduced to a minimum.

The iron operates on current taken from any electric light socket.

Power Driven Hedge Trimmer

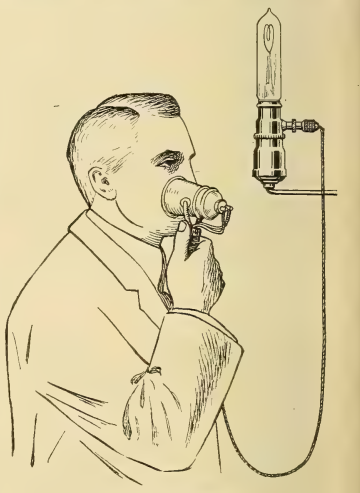
A power driven hedge trimmer is not as yet an article of universal need in this country but as hedges are rapidly supplanting the more familiar garden fence, it will become so as time goes on. A patent on such a machine was recently granted to E. I. Bullock of Ridley Park, Penn. In operation it resembles the familiar barbers' clipper, the power being supplied by the motor mounted as shown, current for it being obtained by connection to the house supply circuits through a long extension wire.



HEDGE TRIMMER

The Respirone

The nose and its connecting passages may be compared to a many storied apartment house with its connecting walls and rooms. These walls, covered



USING THE RESPIRONE

with a delicate and sensitive mucous membrane readily become infected with various germs, or irritated and inflamed by foreign particles. Certain medicines or disinfectants are beneficial in such cases, but difficulty arises in getting the medicines to the seat of the trouble.

Manifestly the medicines can be most easily and effectively applied in volatilized form and the electric Respirone is the most modern instrument for this purpose.

The essential feature of the instrument is the receptacle or reservoir. This receptacle contains what is known as the volatilizing pad in which is contained a small rheostat or resistance. When the medicine is placed in the receptacle it is continually fed to the volatilizing pad and the heat generated by the current passing through the rheostat raises it to its volatilizing point and it becomes converted into a dense gaseous vapor. By an ingenious arrangement of valves and couplings the receptacle is connected to the face mask which fits snugly over the mouth and nose and when the patient inhales, all the air that is taken into the respiratory organs passes through the receptacle and becomes mixed with the volatilized medicine, so that the medicine is bound to reach any part that the breath will reach. It would be impossible to prevent it from doing so.

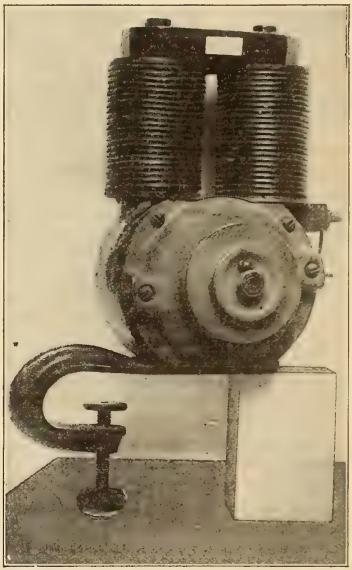
In this manner, without altering their efficiency in any way, these medicines are changed from a liquid to a gaseous form and are inhaled.

Early Electric Motors

Recently an advertisement was published offering to buy one of the original C. & C. electric motors and more than a dozen answers were received, most of which state that the machines are still in good working order. This is remarkable because these motors were designed and built in 1886, more than a quarter of a century ago, by C. G. Curtis, F. B. Crocker and S. S. Wheeler. See U. S. patents.

These are undoubtedly the first electric motors to be manufactured in quantities and not constructed individually. Up to that time the efficiency of small machines had been very low, but these motors were so well designed and built that they actually had efficiencies more than five times greater than the cotemporaneous types of similar size.

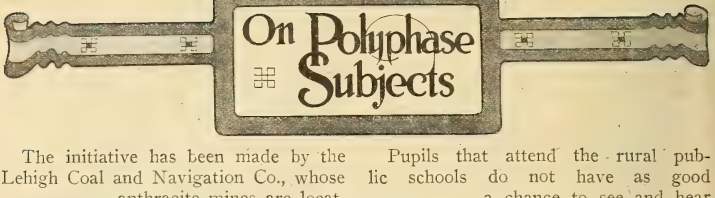
The armatures were wound by machinery and flat wire was used to save space. The connections of the armatures to the commutator were provided for by the winding machine which automatically made projecting turns of wire at the right points. The armature, commutator and brushes were enclosed by the end plates which carried the bearings. In fact, these very early machines were



ONE OF THE FIRST COMMERCIAL MOTORS

essentially the same in this respect as the present enclosed types of electric motors which were brought out more than ten years later.

It is particularly interesting to note that in 1886, when these motors were brought out, there were so few electrical supply circuits available that a special primary battery was devised to be sold with each motor as a source of current, otherwise their use would have been very restricted.



A Move in the Right Direction

The initiative has been made by the Lehigh Coal and Navigation Co., whose anthracite mines are located principally in Lehigh and Northampton Counties in Pennsylvania, by merging 38 power plants, which are to be supplied with energy from one central point. The power generated will be direct from the refuse matter in the preparation of the marketable sizes of anthracite coal and from immense stocks of this refuse which have accumulated for years.

So successful has been the experimental tests made in supplying their own collieries with power from this source that the outlying districts within a radius of 75 miles, covering two or more counties, have merged as above stated, and have been ratified by the state authorities. The matter of transmitting the subtle energy from this source to Philadelphia is being talked of and may take on form at an early date. The capitalization is $3,700,000.

A similar combination, ratified by the state, has been effected in the Hazleton and Shenandoah districts, which includes both electric and gas plants.

So far as the utilization of this waste refuse, commonly known as culm, is concerned, the general consensus of opinion is that this is a move in the proper direction. It has been suggested further to consume not only the carbon in these immense culm banks, but to transform all fuel that comes from the mine's mouth (except that which is necessary for direct heating) into electrical energy and transport it by wire to the markets, thus eliminating expensive freight charges.

Rural School Pupils

Pupils that attend the rural public schools do not have as good a chance to see and hear of the practical applications of science as do the town and city boys and girls. A man teacher of a rural school who understands boys realized that his pupils, especially the boys, needed something to interest them more than their lessons.

One day he brought to the school a box of electrical articles consisting of "Fun with Electricity," belt, battery magnets, compass, etc. He promised the pupils if they would have their lessons prepared and were good that every day he would show them some experiments.

The result was wonderful. The smoldering spark in the breast of most of the boys was kindled into a flame for they now had their greatest desire fulfilled. They were going to be electricians or electrical engineers.

Electricity and Growing Plants

In a bulletin of the Belgian Electrical Society some details are given of the effects of electricity on growing plants. The author states that the powerful illumination from naked arc lamps is especially injurious, but if the ultraviolet rays are eliminated the effect of the electric illumination is to increase the formation of chlorophyl and the assimilation of growing material by the plant. Recent tests show the following increased production of crops under electric light, in addition to the normal solar illumination: Strawberries, 35 per cent; potatoes, 50 per cent; beets, 35 per cent, together with increased sugar content; cereals, 20 to 40 per cent.

When one has the telephone receiver down, if Central turns on the ringing juice a smart shock may be received. Two-year-old "Billie" Harvey was not aware of this painful possibility, although she had been in the habit of going to the desk phone and holding extended conversations with real or imaginary people. One day she rushed from the room, wild-eyed and screaming at the top of her voice—"Mamma! Mamma! Central bite me!"

* * *

"I see you are carrying home a new kind of breakfast food," remarked the first commuter.

"Yes," said the second commuter, "I was missing too many trains. The old brand required three seconds to prepare. You can fix up this new kind in a second and a half."

* * *

One enterprising concern displayed in great illuminated letters, "Open All Night." Next to it is a restaurant bearing with equal prominence the legend:

"We Never Close."

Third in order is a Chinese laundry, in a little, tumbledown hovel, and upon the front of this building is the sign, in scrawling letters:

"Me Wakee, too."

* * *

As the Sunday school teacher entered her class room, she saw leaving in great haste a little girl and her smaller brother.

"Why, Mary, you aren't going away?" she exclaimed in surprise.

"Pleathe, Mith Anne, we've got to go," was the distressed reply. "Jimmy'th thwallowed hith collection."

* * *

A doctor was attending a dangerous case where a Scotch butler was engaged. On calling in the forenoon he said to Donald: "I hope your master's temperature is much lower to-day than it was last night."

"I'm no sae very sure aboot that," replied the butler, "for he dee'd this morning."

* * *

"My papa's just been called by the Lord to a new church," said the little girl.

"Ith he goin' to go?" lisped the other little girl.

"We don't know yet," said the little girl. "The Lord didn't mention the salary."

"Whatsoever a man soweth, that shall he reap." Johnny repeated it after his father several times and seemed to have mastered the correct wording.

As they drew near the Sunday school the father gave Johnny his last rehearsal. "Now, son," he said, "let's have the Golden Text once more."

This is what he got:

"Whatsoever a man sews always rips."

* * *

In Kansas liquor can only be sold as a medicine. As a New York visitor was buying a toothbrush in a Kansas drug store a cowboy entered with a four-gallon demijohn. He plumped this down on the counter, the druggist looked at him inquiringly, and he said:

"Fill her up, Jim. Baby's took bad."

* * *

Sea Captain — "Waiter, what do you call this?"

Waiter — "Bouillon, sir."

Sea Captain — "Well, well, I must have sailed on bouillon all my life and did not know it."

* * *

He engaged a German cook not long ago. His wife liked the appearance of the applicant.

"I'd like to have you come," said the lady of the house, "but perhaps you won't want to live with us. We are vegetarians and never have any meat in the house. Would you be satisfied with a vegetable diet?"

The fraulein scratched her head.

"Vell," she said dubiously, "iss beer a wegetable?"

* * *

Aspiring to be an author and to write a real book, a young man approached a literary friend for advice and pointers on the subject. Among other things the friend told him to be sure and make the very first sentence strong—with originality to grip the attention of the reader and get him interested at the very start. The young man went back and labored and burned the midnight oil until finally the book was completed and set in type. Then he sent a proof to his friend and the friend read the opening sentence. What he saw was this:

"Oh hell! exclaimed the duchess, who up to this point had taken no part in the conversation."

ONCE UPON A TIME THERE WAS A POET WHOM IT WAS NOT ENTIRELY IMPOSSIBLE TO PERSUADE TO TAKE MONEY FOR HIS WORK

AN EDITOR WROTE HIM —"I HAVE AN IDEA FOR A POEM - COME AND SEE ME ABOUT IT"—

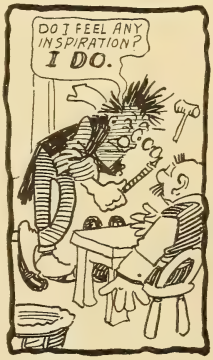
SO, THE EDITOR'S SANCTUM BEING IN ANOTHER CITY, THE POET DRESSED UP & BEAT IT DOWN TO THE DEPOT—

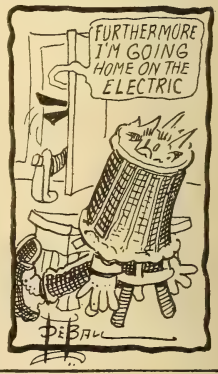
THIS SHOWS THE POET WADING THROUGH THE SMOKE THAT FILLED THE TRAIN SHED—

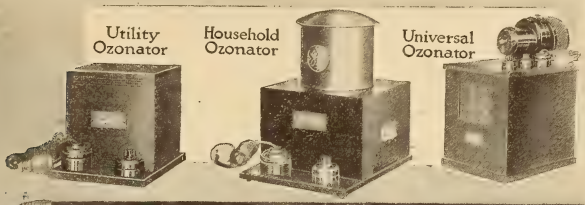
VIEW OF THE TRAIN PASSING THROUGH THE MOUNTAINS OF MAYWOOD ILL. X MARKS THE SPOT WHERE THE POET HAS HIS HEAD OUT OF THE CAR WINDOW LETTING IT LOOK AT THE BEAUTIFUL SCENERY—

WHILE HE HAD HIS HEAD OUT THE WINDOW THE POET GOT A CINDER IN HIS EYE & ANOTHER LARGER CINDER IN HIS OTHER EYE

THE POET AT THE SANCTUM-SEE THE SOOT ON HIS FACE-NOTE THE MANIACAL GLARE OF THOSE CINDER LADEN ORBS- THE EDITOR IS SAYING- "I WANT A POEM ON 'BEAUTIFUL NATURE, VIEWED FROM A CAR WINDOW'- DO YOU FEEL ANY INSPIRATION?







Ozone

Recognizing ozone's many uses in the industrial arts and its possibly larger field in ventilation and sanitation, we have produced simple electrical machines which furnish ozone in any desired quantity for any purpose.

Where Crowds Gather

The G-E Ozonators illustrated can be attached to any lamp socket and use but a few cents' worth of electricity per day. They can be used to supply ozonized air to hospitals, stores, hotels, theatres, schools, and wherever crowds gather.

Where Offensive Odors Prevail

Ozone is also effective in destroying offensive and disagreeable odors. In fertilizer plants and in factories which work gelatin, glue, hides, hair, fat, bone and similar products, this use of ozone will be readily appreciated, not only by the manufacturer and his employees, but especially by residents in the vicinity of the factory.

Sizes for All Uses

Utility Ozonator. A small machine intended for application in out of the way places such as basements, closets, kitchens, lavatories, etc.

Household Ozonator. Of the same general construction as the Utility and for general application in the household. Can be located wherever convenient and carried from room to room. In houses provided with a furnace it may be placed in the cold air duct and so diffuse ozone gently throughout the house.

Universal Ozonator. A more powerful machine, equipped with blowers, and intended for use in large dining rooms, cafes, theatres, etc.

Special Ozonators

Larger special machines are available for ventilating systems and for producing ozone in very great concentration for chemical and manufacturing purposes. Prices and further information on request. If you have special manufacturing problems where ozone may be used as a bleaching agent or deodorant, or for any other special purpose, your problem will be given special attention by expert engineers.

Your electric lighting company or nearest electric dealer will supply you with the regular sizes of G-E Ozonators. If you cannot get them locally, write our nearest office for illustrated bulletin, prices and complete information.

General Electric Company

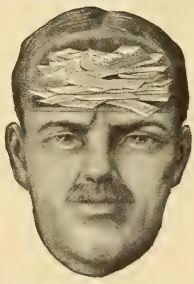
Largest Electrical Manufacturer in the World

General Office: Schenectady, N. Y.

Sales Offices in all Large Cities **Agencies Everywhere**

3997

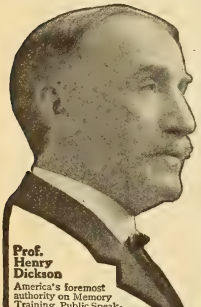
Stop Forgetting!



Make your Mind a File —not a Pile

THE average person's mind resembles a scrap-pile more than anything—heaped high with a vast miscellany of unrelated, unclassified, unindexed facts. To summon *on the instant* from this disordered pile a needed name, date, fact or circumstance is as uncertain a process as seeking in a big library for an unindexed book. A world of information in the storehouse of your mind is as valueless as undiscovered gold—if this accumulated wealth of thought is not systematically on tap.

I will make your mind as well-ordered as a cross-indexed, classified file



Prof. Henry Dickson
America's foremost authority on Memory Training, Public Speaking, Self Expression, and Principal of the Dickson Memory School, Auditorium Building, Chicago.

I will make you master of your mind's infinite ramifications instead of a victim of its disordered details. My systematic course of memory training accomplishes this for you. You can grasp its essentials by ten minutes of pleasurable, interesting, concentrated daily study for just a few weeks. As you progress you will surprise yourself continually by the facility of thought and speech which you acquire. The added degree of confidence—and all loss of self-consciousness—with which you address your colleagues in the business and social world will also be a source of much gratification to you. You will find yourself able to speak on your feet when suddenly called on by your fellowmen at meetings or assemblages of any sort—whereas you probably gurgled foolishly—turned pink—then white—and sat down—before.

The Key to Success

A good memory is as necessary to success as trained muscles are to the athlete. They are acquired in the same way: That is—through systematic exercise. A good memory means more than mental systematization. It means logical, forceful thinking that is the result of the well-ordered mind. It means positive control of self—and ability to influence others through the medium of mental domination.

Now I have told you of some things that will make or mar your success—and all of these factors are things *within your own control*. A little determination on your part, a little effort, a little scientifically directed training, and you rise 'way above the mediocre to a position of success and satisfaction.

Don't condemn my method until I can explain it. There is more in it than you think. Thousands have pronounced my training the turning point in their success. Write me personally if you want the details—or if more convenient—signing and mailing the coupon will do. After you get my plan is time to decide it is not meant for *you—not before*. Will you write me—now?

Prof. Henry Dickson, Principal Dickson School of Memory, 929 Auditorium Bldg., Chicago, Ill.

Send me free Booklet, "How to Remember" also full particulars how to obtain a free copy of Dickson's "How to Speak in Public."

Name _____

Street _____

City _____ State _____

This Valuable Book —"How to Remember—FREE"

Simply clip the coupon—and mail it—or drop me a letter or postal now—just as it is most convenient for you. You will receive my booklet by return mail. Read this booklet carefully—then let me have your application by an early mail. If I receive it within ten days of the date of this offer I will mail you a de Luxe Edition copy of my handsomely-illustrated, richly-bound volume—free of charge.

Send the Coupon or Postal Today

For our Mutual Advantage mention Popular Electricity when writing to Advertisers.

"HELP WANTED"
—Uncle Sam.

Railway Mail Clerks
PARCELS POST means hundreds of appointments.
Examinations everywhere May 3rd.
$900.00 to $1800.00 a Year for LIFE.

No "layoffs" without pay, because of strikes, financial flurries or the whims of some petty boss. Excellent opportunities for quick advancement to Higher Government Positions. If you want immediate appointment, send TODAY for our schedule showing locations of the May 3rd examinations. Any delay means the loss of just so much time in preparing yourself for examination.

SEND COUPON BELOW

FRANKLIN INSTITUTE
Dept. N 115, Rochester, N. Y.

The coupon, filled out as directed, entitles the sender to free sample questions; a free copy of our book, "Government Positions and How to Obtain Them," Full List of Positions Open; and to consideration for Free Coaching for the examination here checked.

We prepare Candidates Free.

COUPON

..Railway Mail Clerk	[$900 to $1800]	..Internal Revenue	[$700 to $1800]
..Postoffice Clerk	[$600 to $1200]	..Stenographer	[$800 to $1500]
..Postoffice Carrier	[$600 to $1200]	..Clerk in the Departments at Washington	[$800 to $1500]
..Rural Mail Carrier	[$600 to $1100]	..Canadian Government Positions	
..Bookkeeper	[$900 to $1800]		
..Customs Positions	[$800 to $1500]		

Name .....
Address ..... N 115

Use this before you lose it. *Write Plainly.*

Wireless Engineering

Study under a Marconi Engineer. Full course including diploma $28.25. Our graduates are making good on land and sea. Operating, Engineering, Office Methods, Drafting by eleven experts. Also languages. *New class starts March 17th. Circular free.*

Y. M. C. A. Telegraph School
EAST SIDE ASSOCIATION INSTITUTE
161 East 86th Street **New York City**

This School is Supreme in Teaching Law by Mail

THE ORIGINAL SCHOOL

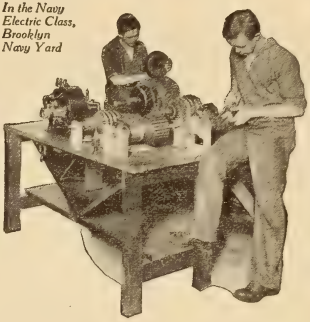
It established correspondence instruction 23 years ago. It was founded on sane methods, sound courses and authoritative teaching. It has never deviated therefrom. It has had phenomenal success and enjoys unlimited respect. Right now

The Sprague Correspondence School of Law

is best equipped—best qualified to teach you law—for legal practice or for business. It is really a SCHOOL. The catalog proves this. And it explains each advantage in detail, lists the thousands of successful graduates, and gives the fair prices for the College Law Course and Business Law Course.

If you want the best—WRITE NOW FOR THIS CATALOG.

The Sprague Correspondence School of Law
292 American Building
Detroit, Mich.



In the Navy Electric Class, Brooklyn Navy Yard

Navy Trades Pay Good Men Well

IF YOU are between 18 and 25, ambitious and of a mechanical turn of mind, read this:

The United States Navy employs men of *50 different trades* to operate and care for the intricate machineries which make up the modern warship.

These men are skilled workmen of the highest order. Some of them have learned their trades before entering the Navy, but most of them have been especially trained for their work in the Navy Department's trade schools and by practical experience on board ship.

These men receive excellent pay, which is nearly all clear money, because board, lodging, and many other advantages are free.

The hours are good and the work is steady—no lay-offs. Promotions with increased wages are easily earned. Chance to save money excellent. The life is far healthier than any factory or shop job can be. And there are frequent changes of scene and plenty of good companionship.

Call at the Navy Recruiting Station near you (look for address in the want columns of your local Sunday newspaper) and get full particulars about different kinds of work, pay, hours, etc. Or write for interesting free books describing Navy trades and the daily life on a United States man-o'-war.

If you put this off, you're likely to forget. So mail a postcard for these books today—*now*.

BUREAU OF NAVIGATION
Box 5, Navy Dept., Washington, D.C.

U. S. NAVY

NEW JOBS NOW OPEN

Earn from $35 to $100 Weekly as a

TRAFFIC MANAGER

Modern transportation is a jungle of **routes** and **rates** calling for specialists who, like the **pathfinders** of old, have expert knowledge of the **trails of traffic.** How to route shipments to obtain **shortest mileage** and **quickest deliveries** and how to **classify** goods to obtain **lowest rates** are two vital factors in business competition. The man who **knows how** is so valuable to his employer that he commands respect and big remuneration.

Big Salaries Paid to Traffic Managers

Expert traffic managers command from $2,500 to $25,000 a year. Why not prepare yourself to fill one of these lucrative positions?

New and Uncrowded Profession

There are half a million LARGE SHIPPERS in the United States. Practically every one of them needs an expert traffic man, and this need is recognized as never before because of the recently enacted railroad rate laws and interstate commerce regulations. The demand for trained and efficient traffic men is many times greater than the supply. *There's room for you.*

Study Traffic and Interstate Commerce

Decide now to become a traffic man. Our Interstate Commerce Course enables you to study AT HOME, without leaving your occupation or sacrificing present income, and to become thoroughly versed and proficient in the *strategy of shipping*, including routes and classifications, interstate commerce rules and regulations, etc. The instruction is given by some of the biggest traffic managers in the country. The course is easy to grasp and thoroughly practical. Anyone with ordinary intelligence, with reasonable application, can master this new profession.

FREE PORTFOLIO Clip coupon below, sign and mail at once, and we will send you *FREE*, postpaid, a handsome portfolio containing complete information concerning the opportunities and requirements of this attractive profession. *Get posted* at once. Clip coupon.

LA SALLE EXTENSION UNIVERSITY, Dept. 41, CHICAGO

FREE PORTFOLIO

COUPON

La Salle Extension University
Dept. 41, Chicago, Ills

I am interested in the new profession—Traffic Management. Please send me full information and Traffic Book, free of all cost.

Name .....

Occupation .....

Signal Engineers Wanted

$125 to $300 A MONTH

Write today! A most wonderful opportunity for the ambitious man. Railroads need hundreds of Signal Engineers. Will pay **big money** for **practical,** trained experts. You need no experience to take up this work. Send a post card immediately.

Chief Signal Engineer

will instruct you personally. Department of Signaling organized to train men to fill these big positions open. Chief Signal Engineer will instruct you **right in your own home** by mail. We teach you to be a **practical expert signal engineer** capable of earning from $125 to $300 a month at the very start.

FREE **$13.50 Outfit to Those Who Enroll at Once**

Don't delay. More trained men wanted right now. Demand growing. Future unlimited. Outfit consists of miniature locomotive, tracks, standards, block signals, etc.

Offer Limited — So Hurry

Just send post card for our catalog and full information. A big chance for you. Send immediately. No obligations.

Dept. of Signaling, Desk 1404
493 Cass Street, Chicago

LEARN TO RUN AND REPAIR AUTOS

This book explains how we can ACTUALLY START YOU in the Auto business after training you at home by a simple system of lessons, charts and models. Great demand for Auto Experts. You can become a repair man, chauffeur or salesman by our system. We have the highest endorsements of big Auto makers. Our 38 page Free book explains All. Write for it.

PRACTICAL AUTO SCHOOL
68-M. Beaver Street NEW YORK, N. Y.

WANTED—SALESMEN AND SALESWOMEN

Hundreds of good positions now open paying from $1,000.00 to $5,000.00 a year. No former experience required to get one of them. We will teach you to be a high grade Traveling Salesman or Saleswoman by mail in eight weeks and assist you to secure a good position where you can earn good wages while you are learning Practical Salesmanship. Write today for full particulars, and testimonials from hundreds of men and women we have recently placed in good positions; also list of good positions open. Address (nearest office) Dept. 130.

NATIONAL SALESMEN'S TRAINING ASSOCIATION
Chicago New York Kansas City San Francisco New Orleans Toronto

LEARN JEWELRY ENGRAVING

in your own home. Earn $20.00 to $50.00 weekly. Personal instructions. Write for free booklet.

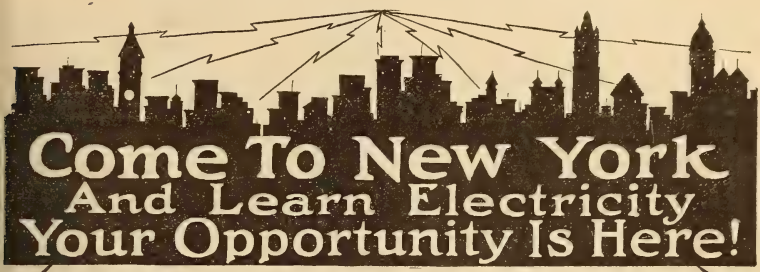
CHICAGO ENGRAVING SCHOOL, 614 Athenaeum Building, Chicago

FREE AUTOMOBILE

To Students who qualify. Ride around taking orders in "Coey Flyer"—6 cylinder—5 passenger car. We teach you to make big money in automobile business. Easy lessons—free model—no experience necessary. First lesson FREE to everyone answering this ad.

C. A. Coey's School of Motoring
Dept. 126
1424-1426 Michigan Av.
CHICAGO, ILL.

Mention Popular Electricity



Come To New York
And Learn Electricity
Your Opportunity Is Here!

The World's Greatest Opportunities Are Open to the Men Who Understand Electricity

There is no field which offers such gigantic possibilities to ambitious young men as the Electrical Field. New York is the world's authority on things electrical. Every scientific appliance is used here that has been proven practical. New York's Electrical Power Plants are the finest in the world and our students are taken through them regularly for inspection and instruction.

We teach you electricity by giving you the actual work to do. YOU LEARN BY DOING!

Every day, new discoveries are being made by men who have studied practical electricity. Our students learn all about the Installation of Burglar, Fire Alarm and Electrical Door Opener Systems, Wiring, Shop Practice and Electrical Repairs. The course also includes Estimating and Contracting, Illumination, Sign Wiring, Direct and Alternating Currents, Switchboard Operation and Construction, Dynamos, Motors, etc. In fact, every branch of *Practical Electricity* is taught so thoroughly and so personally that when a student graduates and has his certificate he is several years ahead of the experienced man in the field who has not had special training such as we give.

The course can be completed in six or eight months although no student is limited as to time. *He stays here and studies until he is actually qualified to hold a good paying position* with any of the large electrical companies, mining, Public Utility Corporations or any other of the large concerns who need *master* electricians. Or he can go into business for himself. This is NOT a correspondence school but a school where YOU LEARN BY DOING.

Write to-day for FREE book and full particulars. This is a real opportunity for "live wire" men who want to get ahead in the world and make something out of themselves. Write *NOW!*

The New York Electrical School
40 West 17th Street
New York

USE THIS COUPON AND GET OUR FREE CATALOG AND FULL PARTICULARS.

N. Y. Electrical School, New York City:
Please send me your FREE Catalog and full particulars regarding your school.

Name.....

Street.....

City.....
(Write Plainly) (40)

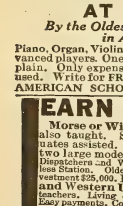
Get there—Yourself!

Don't stop to envy the successful man. *Study* and *ambition* have placed him where he is to-day—*and YOU have the same chance!* **Study at Home!**

Drafting Pays Big Salaries

Machine Drafting, Machine Design, Structural and Architectural Drafting and Design, Builders' Courses, Plan Reading, Estimating, Contractors' Courses, Etc Regular and short courses. Students study blue prints of buildings and machinery in actual construction. Low tuition, easy payment. **Free employment bureau. Free outfit to all Home Study students.** Study at home in leisure hours; work is same as in our college day and evening classes. Both resident and correspondence courses. State which you want.

CHICAGO TECHNICAL COLLEGE
609 Athenæum Building, Chicago, Ill.



Do You Like to Draw?

That's all we want to know

Now we **will not** give you any **grand prize** or a lot of **free stuff** if you answer this ad. Nor do we claim to make you **rich in a week.** But if your are anxious to develop your talent with a successful cartoonist, so you can make money, send a copy of this picture with **6c** in stamps for **portfolio** of cartoons and **sample lesson** plan, and let us explain.

THE W. L. EVANS SCHOOL OF CARTOONING
325 Ball Bldg., Cleveland, O.

MUSIC TAUGHT FREE

AT YOUR OWN HOME

By the Oldest and Most Reliable School of Music in America—Established 1895

Piano, Organ, Violin, Mandolin, Guitar, Banjo, etc. Beginners or advanced players. One lesson weekly. Illustrations make everything plain. Only expense 2c per day to cover cost of postage and music used. Write for **FREE** booklet which explains everything in full.
AMERICAN SCHOOL OF MUSIC, 38 Lakeside Bldg., CHICAGO

EARN TELEGRAPH

Morse or Wireless. Station Agency work also taught. Splendid opportunities. Graduates assisted. We own and exclusively occupy two large modern buildings equipped with R. R. Dispatchers and Western Union Wires and Complete Wireless Station. Oldest and largest school—28 years. Investment $25,000. **Endorsed by Railroad, Wireless and Western Union Officials.** Expert, practical teachers. Living expenses may be earned. Tuition low. Easy payments. Correspondence courses also. Catalogs *Free.*

Dodge's Telegraph, Railway & Wireless Institute
21st Street Valparaiso, Ind.

COPY THIS SKETCH

and let me see what you can do with it. You can earn $20.00 to $125.00 or more per week, as illustrator or cartoonist. My practical system of personal individual lessons by mail will develop your talent. Fifteen years successful work for newspapers and magazines qualifies me to teach you.

Send me your sketch of President Wilson with 6c in stamps and I will send you a test lesson plate, also collection of drawings showing possibilities for YOU.

The Landon School of Illustrating and Cartooning
1451 Schofield Building, Cleveland, O.

TEACH BY MAIL

WRITE FOR MY FREE BOOK

"HOW TO BECOME A GOOD PENMAN"

and beautiful specimens. Your name elegantly written on a card if you enclose stamp. Write today. Address **F. W. Tamblyn,** 437 Meyer Bldg., Kansas City, Mo.

ELECTRICAL ENGINEERING

men with training are always in demand. Having trained over 800 young men in the past 20 years in the fundamentals of Applied Electricity, **The Bliss Electrical School,** with its well-equipped shops and laboratories, is peculiarly well qualified to give a **condensed course** in Electrical Engineering including Mathematics, Steam and Gas Engines, Mechanical Drawing, Shop Work, and Theoretical and Practical Electricity, in all branches. Students construct dynamos, install wiring and test efficiency of electrical machinery. Course, with diploma, complete

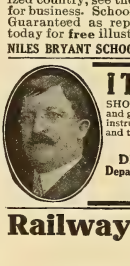
IN ONE YEAR

For practical young men with limited time. 21st year opens Sept. 24th. Catalogue on request. 12 Takoma Ave., Washington, D. C.

PIANO TUNING PAYS

Learn the most independent of all professions. You can learn quickly and easily by devoting your spare time for a few weeks, to our correspondence system. Our wonderful invention the TUNE-A-PHONE eliminates all guess work and assures success with or **without** a knowledge of music. We furnish full size **action model** and necessary **tools.** You can earn $5 to $15 per day, travel in any civilized country, see the world and regulate your **own hours** for business. School chartered by State. Diploma granted. Guaranteed as represented or tuition refunded. Write today for **free** illustrated book and valuable information.

NILES BRYANT SCHOOL 151 Art Institute, Battle Creek, Mich.



I TEACH SIGN PAINTING

SHOW CARD WRITING OR LETTERING by mail and guarantee success. Only field not overcrowded. My instruction is unequalled because practical, personal and thorough. Easy terms. Write for large catalogue.

CHAS. J. STRONG, Founder
DETROIT SCHOOL OF LETTERING
Department 113 Detroit, Mich.
"Oldest and Largest School of its Kind"
"Thoroughly equipped Residence School"

Railway Mail Clerk Exam

MAY 3rd

Let Me Prepare You. Write NOW for Free Booklet 92

ARTHUR R. PATTERSON, Civil Service Expert

Former U. S. Civil Service Secretary-Examiner Rochester, N. Y.

TELEGRAPHY TAUGHT

in the shortest possible time. The Omnigraph Automatic Transmitter combined with standard key and sounder. Sends you telegraph messages at any speed as an expert operator would. Five styles, $2 up; circular free.

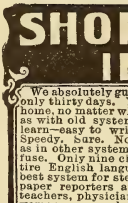
OMNIGRAPH MFG. CO.
39 H Cortlandt Street New York

LEARN WATCHMAKING AND ENGRAVING

Earn while learning. Most practical watch school. Individual instructions. Graduates in great demand. Book free.

CHICAGO SCHOOL OF WATCHMAKING
65 E. Van Buren Street Chicago

BE A BANKER



Learn a profession that will give you standing and independence. Splendid opportunities. Pleasant work, short hours, all holidays off, yearly vacation with pay, good salary. Diploma in six months. Text books by Edgar G. Alkorn. Catalog free.

AMERICAN SCHOOL OF BANKING, 139 McLene Bldg., Columbus, Ohio

SHORTHAND IN 30 DAYS

We absolutely guarantee to teach shorthand complete in only thirty days. You can learn in spare time in your own home, no matter where you live. No need to spend months as with old systems Boyd's Syllabic System is easy to learn—easy to write—easy to read. Practical. Speedy. Sure. No ruled lines—no positions—no shading as in other systems. No long lists of word signs to confuse. Only nine characters to learn and you have the entire English language at your absolute command. The best system for stenographers, private secretaries, newspaper reporters and railroad men. Lawyers, ministers, teachers, physicians, literary folk and business men and women may now learn shorthand for their own use. Does not take any additional practice as with other systems. Our graduates hold high grade positions everywhere. Send to-day for booklets, testimonials, etc.

CHICAGO CORRESPONDENCE SCHOOLS
949 Chicago Opera House Block, Chicago, Ill.

Be the Boss

Get in the New Profession

Thousands of men are needed. The new profession that is **paying big money** wants you and needs you. Here is your opportunity to get into it **now.** You don't need to leave your present employment. Just a few hours a day **in your own home** and soon you get your diploma and you are a full-fledged Meter Engineer.

Be a Meter Engineer

The profession of Electrical Meter Engineering is now in its infancy. It is calling for men. The Central Electric Stations ***must*** have Meter Engineers, because without them they cannot operate. Thousands of positions now open. Over 400,000 new meters are going to be installed next year. Just think of the vast army of men that will be needed. And besides, Meter Engineers now are so scarce that the Central Stations are willing to pay huge sums for competent men. ***YOU*** can get into the profession. It is calling you.

A $3,000 Job for YOU

Electrical Meter Engineering is one of the best paying professions in the electrical industry. We can show you hundreds of men who are making better than $3,000 each year. **How would you like to have a $3,000 a year job six months from now?** Just put your name and address on the free coupon and get full particulars absolutely free. Send coupon now—***today.***

Special

For a limited time we are making a special reduced price offer in order to induce men to start the study of Meter Engineering right away. Write for full particulars at once.

Send the Coupon for FREE Book

Do not delay an instant. Just put you name and address on the coupon and mail it to us at once. We will send you absolutely FREE and postpaid, our new book on Meter Engineering. It tells you all about the New Profession and about our school. It tells you how you can learn to become a Meter Engineer in your own home during your spare time. Absolutely no obligations of any kind. Just your name and address is enough. But write today—now—immediately while we can still make this great special offer.

Fort Wayne Correspondence School
Dept. 1404. **Fort Wayne, Indiana**

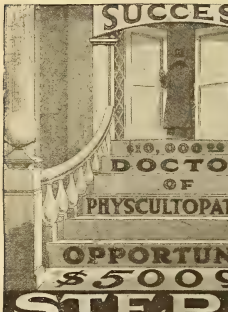
FREE Book Coupon

Fort Wayne Correspondence School
Dept. 1404. Ft.Wayne, Ind.

Gentlemen: Please send me absolutely free and prepaid your book on Meter Engineering. Also send me full particulars of the great special offer that is now being made to induce men to study Meter Engineering. I assume no obligations of any sort.

Name .....

Address .....



Don't Tie Thyself with the Thousand Thongs of a Timeworn Trade

Take Your First Step Today to Learn a Profession

Become a Physical Culture Doctor

In one Year You Can Obtain a Diploma with the Degree of DOCTOR of PHYSCULTOPATHY and BE INDEPENDENT FOR LIFE

Home Study Course Complete in the theory of Physcultopathy. Lesson simplified for self-teaching, easily and quickly learned. Complete Course in 75 lessons. Enrolment may be made any time. EASY MONTHLY PAYMENTS.

Macfadden Encyclopaedia Free The Macfadden Encyclopaedia of Physical Culture, which is the main text book of the Course, is included in the tuition as well as five other text books ABSOLUTELY FREE. *WRITE TODAY FOR FULL PARTICULARS.*

Macfadden College of Physcultopathy, 4208 Grand Boulevard Chicago, Illinois

LAW

LEARN AT HOME

SEND FOR BIG FREE LAW SCHOOL BOOK

G-R-E-A-T Scholarship Offer

At this time we offer you a **Tuition Credit Valued at $100.00, Absolutely Without Charge.** It entitles you to a complete three years' Course in our big law school—Lectures, Faculty Talks, Examinations and the services of our Consulting Department. Only expense for text and postage. **Offer is limited—Hurry—write immediately for full particulars.**

Superior Advantages of Our School

Ten years successful experience teaching law by correspondence—large and distinguished faculty—Course prepares for bar in ANY STATE—simple, easy and direct method of instruction—same as *Harvard, Columbia and other big law schools.*

We Furnish a Magnificent Law Library With Every Scholarship

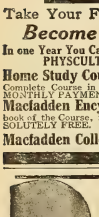
Original cost $50,000—12 volumes—covers all subjects of law—endorsed by Bench and Bar.

Write Today Just send post card for big Law School Book and full particulars of GREAT SCHOLARSHIP OFFER. Everything sent *Free and Prepaid.* Hurry—offer limited—send IMMEDIATELY.

AMERICAN CORRESPONDENCE SCHOOL OF LAW

(Largest Law School for Home Study in the World)

Dept. 1404 Manhattan Bldg. Chicago, Ill.



I WILL MAKE YOU PROSPEROUS

If you are honest and ambitious write me today. No matter where you live or what your occupation, I will teach you the Real Estate business by mail; appoint you Special Representative of my Company in your town; start you in a profitable business of your own, and help you make big money at once.

Unusual opportunity for men without capital to become independent for life. Valuable Book and full particulars Free. Write today.

NATIONAL CO-OPERATIVE REALTY CO.
M141 Marden Building
Washington, D. C.

F. B. Marden, Prest.

THE AMATEUR CRAFTSMAN Tells how to make an AEROPLANE, canoe, sail-boat, telephone, furniture, toys, shack, animal traps, camping, etc. Fully illustrated. Builder's square and poster free. All for 10 cents, 3 for 25 cents.

W. H. MILLER CO., St. Paul, Minn.

FRENCH—GERMAN SPANISH—ITALIAN

Is Easily and Quickly Mastered by the

LANGUAGE PHONE

Combined with the

Rosenthal Method of Practical Linguistry

This is the natural way to learn a foreign language. You hear the living voice of a native Professor pronounce each word and phrase. He speaks as you desire—slowly or quickly, night or day, for minutes or hours at a time. It is a pleasant, fascinating study; no tedious rules or memorizing. It is not expensive—all members of the family can use it. You simply practice during spare moments at convenient times, and in a surprisingly short time you speak, read and understand a new language.

Send for Booklet and Terms for Easy Payment

THE LANGUAGE PHONE METHOD
946 Putnam Building, 2 West 45th Street, New York

LONG-LIVED ANIMALS TAKE VITAL FOODS

Long life thru vital foods

The everyday BRAINY or LIFE-GIVING foods are the most strengthening, healing forces in nature. They promote the highest efficiency in brain workers. When correctly combined they maintain health permanently.

Wrongly combined foods ferment and poison the system, causing rheumatism, appendicitis, apoplexy, etc., lack of appetite, and frequently death. The different foods causing expectoration, catarrh, fevers, nightsweats, coughing, etc., are specified in the instructive free booklets. Fat people have reduced one pound daily by a DIGESTIBLE brainy diet of everyday foods, gaining strength, without fasting, or exercises. Thin people gain flesh by the DIGESTIBLE weight-producing foods.

NO FOODS SOLD

People write:—"My brain power and general efficiency have been nearly doubled this year by selecting brainy foods. I have made a fortune in real estate, and the credit is honestly yours." . . . . "The hints on foods for curing congested liver, nourishing the brain, etc., are worth untold dollars."

SHORT-LIVED ANIMALS TAKE DEATH-PRODUCING FOODS

THE NEW BRAINY DIET SYSTEM
Chapters on Diet vs. Drugs, Effects of Foods, Foods for Singers.

Send 10 cents for the Instructive Booklet. Send the addresses of your sick friends.

G. H. BRINKLER, Food Expert, Dept. 19D Washington, D. C.

For our Mutual Advantage mention Popular Electricity when writing to Advertisers.

Practical Electrical Education

WE teach *all* branches of *Electrical Science* and *Engineering* by *practical work* and *scientific methods* under practical working conditions. ***You may enter at any time—Day or Evening Classes.***

No matter what your present education is you can enter this school at any time with full assurance of a thorough training and graduate an expert. We will start you at the point you are competent to begin and you will advance as quickly as your own efforts and ability warrant. Positions secured for students and graduates. Many now well employed. Names on request. Full particulars and interesting catalogue **free.** Get it and see what *real* electrical education is.

Write Right Now — Clip The Coupon

SCHOOL OF ENGINEERING OF MILWAUKEE
161-171 Michigan St. Milwaukee, Wis.

Send me without obligations on my part your 40 page Book of Valuable Electrical Facts Worth Knowing.

NAME .....

ADDRESS .....

.....

FREE BOOK ON MOTORING

Explains how we can start YOU in the Auto Business as Repairman, Chauffeur, Salesman or Auto Mechanician with DYKE'S NEW IDEA WORKING MODEL SYSTEM of teaching by mail and our new idea EMPLOYMENT PLAN. Let us tell you the names of some of our students and the salaries they are drawing today—more than you are making. Don't miss it—Send for Booklet *of its kind in the world.*

A NEW IDEA OF TEACHING BY MAIL WITH DYKE'S WORKING MODELS CHARTS, MANIKINS, ETC.

DYKE'S SCHOOL OF MOTORING, Box 2, Roe Bldg., ST. LOUIS, MO.

Y. M. C. A. Auto School
7th & Walnut, Cincinnati, Ohio

Gentlemen:—Please send me your catalog telling about 6 weeks course of Repairing, Driving and Lectures, which you say will fit me for a good position as Chauffeur or Repairman.

Name.....

Address.....

Cut This Out and Mail Today

A Course of Lessons
—in—
Drugless Healing
[Mechano-Therapy]
FREE!

Not one cent to pay either now or later—no obligations of any kind or nature. Just your simple request will bring you this valuable and interesting course of 62 lessons by return mail *without cost.*

This is the *first* time such an offer has ever been made. It may be the *only* time. We cannot urge you too strongly to accept this exceptional opportunity *without a moments hesitation.*

This offer is *strictly limited.* As soon as a certain number of courses have been mailed, we shall be compelled to withdraw the offer. *So don't wait a minute.* Send your acceptance *right away.*

These Free Lessons Teach You

How to Treat Headache	How to Treat Catarrh
How to Treat Neuralgia	How to Treat Epilepsy
How to Treat Constipation	How to Treat Hay Fever
How to Treat Indigestion	How to Treat Paralysis
How to Treat a Sprain	How to Treat Pleurisy
How to Treat Dyspepsia	How to Treat Asthma
How to Treat Rheumatism	How to Treat Gout
How to Treat Lumbago	How to Treat Jaundice

Besides dozens of other important health subjects which every one should know. Every single step explained and pictured so plainly that you cannot fail to understand.

WHY We Are Making This Offer

We want the public to know the *real truth* about Drugless Healing. We want you to convince yourself by a practical demonstration just what a wonderful new curative force may be placed at your command.

Besides, these free lessons will demonstrate just how thoroughly, how easily and in what a surprisingly short time you can master this wonderful new profession, at home or in class, without interfering with your regular occupation the slightest.

If you want to earn $2500 to $6000 a year, if you want an established profession that is pleasant, dignified and remarkably profitable, if you want to become master of your own and others' health and happiness then send for the Free Course and see what Drugless Healing has to offer you.

Hundreds of successful graduates in every quarter of the world demonstrate the wonderful efficiency of our methods. What about yourself? Are you satisfied? Are you contented—healthy—happy in your work—making all the money you want? If not, send postal on Drugless Healing right away.

Remember: This Offer is Limited

Write NOW for FREE Course of Lessons

Don't wait to think it over. Don't hesitate at a chance like this. Get the facts—the real truth—learn what you can do—what you can earn as a Mechano-Therapist. The Free 62-Lesson Course and our free book explain all. Send just the coupon or a postal or letter right away.

American College of Mechano-Therapy
Dept. 775
81 West Randolph St.
CHICAGO, ILLS.
(116)

Without cost or obligation, please send me by mail, prepaid, your free book and the course of 62 lessons in Drugless Healing.

Name.....

Address.....

American College of Mechano-Therapy
Dept. 775
81 W. Randolph St.
Chicago, Ills.

Learn Electricity!

Earn $150.00 TO $300.00 a Month

Electricity is today the great motive power of the world. Its use has extended to every phase of life and industry.

Thos. A. Edison says that the field of electricity is in its infancy—that electrical workers of the future will discover uses for this great force now undreamed of.

Right now there are not enough electrical engineers to fill the big paying positions open. Every day our **Free Employment Bureau** has a call for Electrical Engineers greater than we can fill. Therefore, we are making a **very special offer** to students at this time.

Write today! Send the free coupon for our catalog and free information.

We Teach You in a Short Time —at Small Expense

In order to supply more electrical engineers we are charging a small tuition fee. Your tools and equipment of all kinds are furnished **FREE** by the School. You may have **easy payments if desired.** Our course of instruction is clear, simple and thorough. Our Graduates demand handsome salaries. Don't pass up this opportunity.

FREE TOOLS

We will furnish all the material and tools you use in taking our course —ABSOLUTELY FREE. All we charge is a very small amount for tuition. Many of our students earn their expenses while taking the course.

Men Wanted for these Trades

Electricity Plumbing
Moving Picture Operating
Mechanical Drawing

We also teach the trades mentioned above. There are unlimited possibilities in any one of these trades. When you have completed our course you will be in a position to demand from $5.00 to $8.00 a day right at the start. Or go in business for yourself and make from $3,000 to $5,000 a year.

Send the FREE COUPON for Catalog and Particulars

No obligations on you at all. Just fill out the coupon and mail it today. Take this step towards **success.** Let us tell you how **you** can master electricity or any other profitable trade in a short time—make a bigger success than you ever dreamed of making. Fill out the coupon and mail it at once.

L. L. COOKE, Director

Coyne National Trade Schools
39-51 E. Illinois St.
Dept. 1404
Chicago, Ill.

FREE COUPON

L. L. COOKE, Director

Coyne National Trade Schools
39-51 E. Illinois St.
Dept. 1404, CHICAGO, ILL.

GENTLEMEN: Without any obligations on me whatsoever, please send me your school catalog and full particulars of this offer to men—ALL FREE.

NAME.....

ADDRESS.....

Be a Doctor of Chiropractic

The New Drugless Healing Science OF SPINAL ADJUSTMENT

A Dignified, Profitable Profession Easily Learned at Home. Steady Demand for Practitioners Everywhere—Our Students Surprisingly Successful.

Make $3000 to $5000 a Year

Your income as a Chiropractor can be this much or more year after year. At the same time you will be serving suffering humanity. Dr. Walter made $500 the third month after starting; R. M. Johnson has added over $3,000 a year to his income; Vern Sharpsteen makes $40.00 a day. In addition, this fascinating profession is building up for these former students of ours a splendid social and professional reputation.

We taught these men in their spare time by correspondence, and in class, to be Doctors of Chiropractic—the

NEW DRUGLESS HEALING SCIENCE of Spinal Adjustment

—and thereby **made them independent for life.** We will **guarantee** to teach you with **equal success.** A common school education is all you need to begin—our simplified training does the rest.

Sample lesson sheets and illustrated book giving full instructions how to get into this well-paid, uncrowded profession at once—mailed FREE

National School of Chiropractic, Dept. 142, 1553 W. Madison St., Chicago.

Books That Really Teach

the things you want to know, and in a simple, practical way that you can understand.

Our illustrated catalogue will be SENT FREE upon request, tells all about the Practical Mechanical Books for Home Study that **we publish.**

Write today for this up-to-date and complete illustrated Catalogue and popular price list. **IT IS FREE.**

EASY ELECTRICAL EXPERIMENTS AND HOW TO MAKE THEM. By L. P. Dickinson, 320 Pages, 110 illustrations, 12mo, Cloth. Price..... **$1.00**

FIRST STEPS IN ELECTRICITY, OR ELECTRICITY FOR BEGINNERS. By W. Jerome Harrison, 283 Pages, 114 illustrations, Pocket Size, Cloth. Price..... **$1.00**

OPERATORS' WIRELESS TELEGRAPH AND TELEPHONE HANDBOOK. By Victor H. Laughter, 210 Pages, fully illustrated, and with six additional full-page half-tone illustrations showing the installation of "Wireless" on the U. S. War Ships and Ocean Liners, Cloth. Price..... **$1.00**

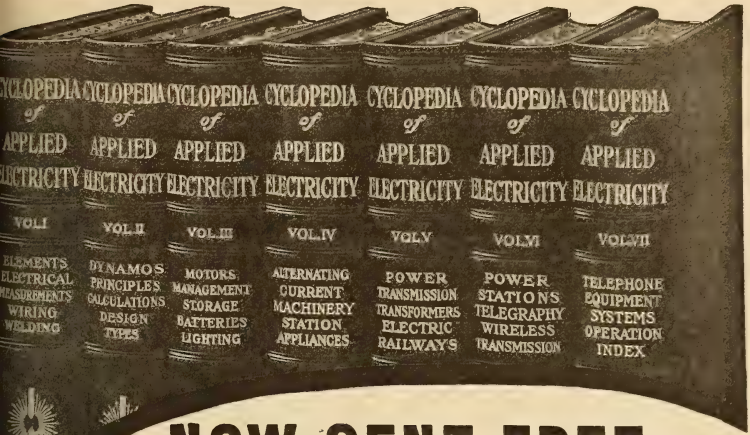
THE HANDY VEST POCKET ELECTRICAL DICTIONARY. By Wm. L. Weber, M. E.
Cloth, Red Edges, Indexed..... **$0.25**
Full Leather, Gold Edges, Indexed..... **.50**

For sale at all Book Stores or sent Postage paid on receipt of price by

FREDERICK J. DRAKE & CO.

Publishers of Self-Educational Books

Dept. 10, 1325 Michigan Ave. CHICAGO, U. S. A.



NOW SENT FREE

This seven-volume set of electrical books—just now offered at a discount of almost 50%—will be sent, **express prepaid,** for seven days' free examination; returnable at our expense. Send no money—simply fill out the coupon and we will send you the most complete and up-to-the-minute reference work of its kind ever published. You, whether student, worker or expert, can gain from these books an intimate knowledge of your work—knowledge which will eventually mean success and higher pay. **The work of thirty-two experts,** this library is recognized as a standard reference work by technical schools, libraries and practical men throughout the country.

The American School's Cyclopedia of

APPLIED ELECTRICITY

Contains 3,200 pages, 7x10 inches; 2,600 illustrations, full page plates, diagrams, etc.; hundreds of valuable tables and formulas; carefully cross-indexed for quick, easy reference. The books are substantially bound in half red morocco, gold stamped, and are printed in large clear type on special quality paper.

Important Subjects Covered by These Great Books

Theory, Calculation, Design and Construction of Generators and Motors—Electrical Measurements—Electric Wiring—Electric Welding—Types of Generators and Motors—Management of Generators and Motors—Storage Batteries—Electric Lighting—Alternating-Current Machinery—Station Appliances—Power Stations—Power Transmission—Central Station Engineering—Electric Railways, including Single-Phase—The Electric Telegraph—Telephone Equipment, Systems and Operation—Wireless Telegraph and Telephone—Telautograph, Telegraphone, etc.

Get These Books At Almost Half Price

The complete seven volumes, not a sample volume, will be sent, express prepaid, for seven days' free examination; returnable at our expense if the books do not contain the information you want. If you keep them, pay $2.00 seven days after receipt and then $2.00 a month until you have paid the special introductory price of $19.80. The regular price of this great Cyclopedia is $35.00. Just fill in and mail the coupon. It won't cost you a cent to examine the books. We know they'll be worth many times their cost to you. Mail the coupon now and you'll receive your books promptly.

$12.00 Consulting Membership Free

With every set is included a year's Consulting Membership, regular value $12.00, entitling you to the free advice of a staff of Electrical Engineers. This will give you practical help in handling working problems which are too specific to be taken up in detail in the Cyclopedia. There will be no limit to this service. A single problem solved for you might be worth more than the first cost of the books.

AMERICAN SCHOOL OF CORRESPONDENCE
CHICAGO, U. S. A.

7 DAY EXAMINATION COUPON

Pop. Elect. 4-13

A. S. of C.

Please send me Cyclopedia of Applied Electricity for seven days' free examination. I will send $2.00 within seven days and $2.00 a month until I have paid $19.80; otherwise I will notify you and hold the books subject to your order. Title not to pass until fully paid.

NAME .....

ADDRESS .....

OCCUPATION .....

EMPLOYER .....

For our Mutual Advantage mention Popular Electricity when writing to Advertisers.

HOW WE CAN DO IT—*These Ten Famous Business Books, Formerly $27, Now—60 CENTS EACH*

We searched the world for a new kind of paper and found it in Germany. We fine-combed America for new processes of printing and binding and we secured them. The result is that we can make our "Supreme Offer" to the business world of these 10 greatest books of business at a price that surpasses all our experience—77% below the original cost—60c each instead of $27.

1497 Vital Business Secrets

Yours to Use Tomorrow Morning

But the man who realizes that this is not just a bargain offer but an opportunity to get actual business experience for a pittance will be the man to profit from reading these facts. We would have to show you these books to make you understand that only after ten years of striving have we been able to make this sweeping offer, to present this downright book value at a cost price, leaving the hundreds of business plans, methods and secrets *free* to you. In the first edition of these books, the chased sets of these books. So this we have to charge you hardly a penny for the contents of the books —only the rock bottom cost of paper, printing, binding, transportation and the mere telling about these books to you.

$1 Brings You All 10 Books

Ask any printer if he can produce these books for 60 cents and he will answer *NO*, for the scratched right and left strong paper to reduce binding and shipping expense. We found it in Germany. Then we used many of our former plates—cutting expense to zero there. Then we got unbelievably low estimates on printing and binding 30,000 sets. The RESULT is a complete business experience which you could not ordinarily obtain after years of uphill work, in your hands for 6 cents a day spread out over four months only. $1 sent today. brings the books to you tomorrow.

112 Great Business Men Tell "How" to Make Business Pay

Think of the two ways before you, one of struggling along for years and years to get experience, the other of having 112 of the world's greatest business men tell you where and how to improve your work and better your money-making in a few evenings of reading leisure. These 112 leading men tell you *how* they meet problems, *how* they turned defeat into victory, *how* they rose from small jobs to the seats of the mighty. Here are not mere generalities, but facts, plans, methods, diagrams, charts which have made money, increased salaries, enlarged businesses, yours to know today and use in your own business tomorrow. The man in charge can increase his producing, managing ability and results; the employee can better position, increase salary, command eventual success.

In 2,097 pages crowded with money-making methods, like a compact correspondence course under the Master Minds of Business, you have placed at your instant disposal the crystallized experience of practically the whole world of business. It is yours to read at your leisure bearing his name). Sears Don't plod and blunder along in a small job expecting to get ahead *somehow, someday*. Don't worry over problems other men have solved. Why spoil opportunities and waste chances, which with the proper knowledge you might turn into money in a week, a month, a year, instead of spending a lifetime to get experience. Then add the help which you will get from SYSTEM, which stands preeminent, the Magazine of Business. 200 to 356 pages every issue, and 100 regular readers. Whether you own your own business or are employed, SYSTEM will show you new ways of saving time and cutting out drudgery. Increase profits, increase salaries, bigger profits, that would have been impossible, undreamed of without SYSTEM.

C. S. Conner "One new idea gained is worth a thousand dollars."
Advertiser

James W. Van Cleave "The big point of merit in your publications is that
Manufacturer—

they give us the actual experience of thousands of other business men, showing how successful the man, he can profit from help like this."

The May Company "The best of us have a good deal to learn
Retailers— from the rest of us. That is the reason why no one ever becomes successful or prosperous may be the employer or employee, he can learn from SYSTEM'S works."
S. M. Gross. Supt.

Alfred Dolge "I wish the Work could be brought before every
Manufacturer— who wants to build a real business career. Millions of dollars might have been saved me loss in experience."

$1 OFFER

We offer you for 6 cents a day, term only four months, these 10 substantial volumes, published in an attractive 20,000-set edition, printed in bold type on fine light-weight paper, full cloth bound with covers in four colors—suitable for any library or desk. And this 6-cent offer includes an 18 months' subscription to SYSTEM (price $8.00). That's $9.00 only in all, spread payments. Sending us your check or money order, or a dollar bill, today will start the books to you tomorrow, all transportation charges fully prepaid, and give you SYSTEM for eighteen months. One dollar now and $2.00 a month until $9 is paid. (West of the Rockies, $10; Canada, $11.) Long before the first month is out, these books will have a chance to put into your pocket many times their cost. Send without delay as this Edition is going to disappear the fastest of any we ever put out. Is the offer clear? There is nothing to sign. TEAR OUT THIS AD SO YOU WON'T FORGET IT.

Simply say, "I accept your offer in Popular Electricity, April. 1913", and write your name and address on a piece of paper, pin all together with your dollar bill and send to

SYSTEM, Wabash Ave. and Madison St., CHICAGO

How to Sell Goods
—How to singer up a sales force —How to drum business in dull seasons—How to route, handle and check salesmen—How to train, develop and coach a sales force—How to win the dealer's cooperation and support—How to meet objections and how to be a good "closer"—How to handle wholesalers and retailers to the best advantage—How to judge a good salesman—How to work the "big stick" plan of selling goods to retailers—How to analyze your proposition and pick out its selling points —How to make the consumer influence dealers to buy your goods—How to get out of the ranks of the "clerks" and become a real salesman.

And hundreds of other vital points and plans for clerks, salesmen, retailers, wholesalers, manufacturers, mail order houses, etc.

How to Buy at Rock Bottom
—How to know to a nicety what stock is on hand—How to keep track of promises, agreements, deliveries, etc.—How to play one salesman against another and take advantage of every opportunity to get a low price —How to thoroughly master the ins and outs of the buyer's position so that you can meet the crack salesmen in every line on equal terms—How to devise a simple system which will bring to your notice automatically, all data, prices, etc., about a given article—How to formulate a complete purchasing and record system for a mail order house, a factory, or a retail, or wholesale dealer.

And other priceless pointers on purchasing that business men should know about.

How to Collect Money
—How to judge credits—How to collect by mail—How to handle "touchy" customers—How to be a good collector and how to hire one—How to organize a credit and collection department—How to weed out dishonest buyers from the safe ones —How to get quick, accurate, inside information about a customer's ability to pay—How to write smooth, diplomatic letters that bring in the money without giving offense—How to devise a simple and effective system for insuring prompt and periodical collections of all your accounts.

And valuable information obtainable in no other way, for credit men, collectors, accountants and every business man interested in this vital department.

How to Advertise a Business
—How to plan and lay out an advertising campaign—How to judge and select the right mediums to reach any given class —How to write, revise, illustrate, display, place and check advertisements—How to develop a crisp, harhitting, goods-selling style of expression—How to prepare bold, original booklines—How to conduct a magazine campaign—How to "drive home" its effect on dealers, wholesalers and consumers alike—How to make a small appropriation count—How to advertise for inquiries and turn them into sales.

And an infinite variety of other practical points on every phase of advertising

How to Meet and Handle Men
—How to develop strong individual personality—How to approach and impress men—How to attract, interest, persuade, conciliate and convince men—How to break down the walls of reserve and prejudice in an interview and turn enemies into cordiality and respect—How to pick men—How to weigh, judge, analyze ability in a prospective employe—How to train and coach your employees—How to inspire men with desperate determination and unfailing loyalty to work, to think, to act, even to fight in your behalf—How to keep in personal working touch with an entire working force, making each man feel your special interest in him. And section after section meeting and managing, directing and controlling, inspiring and developing all sorts and dispositions of human nature.

How to Manage a Business
—How to keep track of stock—How to figure and charge estimates—How to check deliveries and mistakes—How to get the most out of those you have around you—How to size up the money-making possibilities of new ventures—How to detect and eliminate needless items of expense and waste—How to get up blanks, forms, records and simple systems for all kinds of businesses—How to devise a perpetual inventory system that will tell you every day the value of all material on hand—How to turn a losing business into a profitable one—how to make a profitable business more profitable. And dozens of other things that every man in an executive position needs in his daily work.

How to Get Money by Mail
—How to write ads—How to begin a letter—How to turn inquiries into orders—How to formulate a convincing argument—How to get your readers to ACT at once —How to cover territory salesmen can't reach—How to keep tab on results of all mail work —How to keep ads, circulars and all mail sales—How to prepare an enclosure for a business getting letter—How to supplement the efforts of salesmen with live, business-getting letters—How to answer, file and follow up inquiries from advertisements and those which come in the regular course of business.

And page after page of practical working information for mail order firms but particularly helpful to the man starting a specialty of mail order business.

How to Stop Cost Leaks
—How to detect waste—How to make an inventory—How to figure "overhead" expenses—How to systematize an office, factory or store—How to cut out red tape in a simple system—How to keep close watch on material and labor—How to apportion the right number of employes to a department—How to decide between piecework, day wages and bonus systems—How to keep tab on productive values of each machine and employe—How to figure depreciation, burden, indirect expense, upkeep, profit, loss and cost.

And other after chapter of priceless plans for practically every kind of business by which an accurate cost system is essential to money-making and saving.

How to Get and Hold a Position
—How to apply for a position and get it—How to answer an want ad., in person or by letter—How to compose a letter—How to seal letter of application—How to secure the highest market price in selling your services—How to prepare and apply for advancement—How to be steadily gain and hold your employer's confidence—How to master the entire routine, the science, the duties, the problems of the executive, a department head, a general manager—How to study the work of the man above you, without offending, or disturbing him.

Not just advice merely, but practical, down-to-the-earth instructions in the branches of business that will help the ambitious employe to actually earn more—leave others behind.

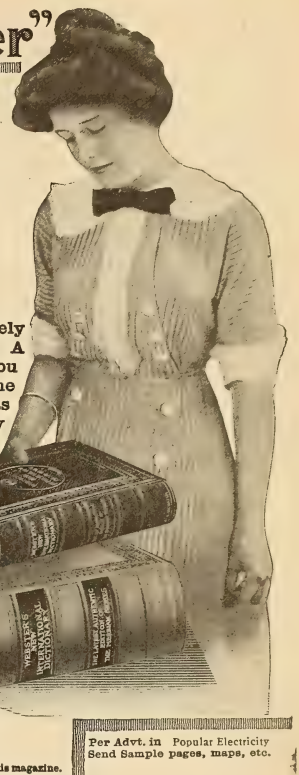
Office and Accounting Methods
—How to keep office accounts —How to install and install a complete record and accounting system—How to keep loose leaf trial balances—How to devise a system that will give you your monthly statement on time—How to install a simple system that will give you a daily report of your business conditions—How to use the loose leaf in handling collections —How to systematize and organize an office—How to speed up an office without impairing efficiency—How to keep exact office control—How to handle a stock-keeping and shipping department, with complete inventory, receiving and shipping blanks and forms for each.

How, in fact, to enjoy peace of mind, comfort and satisfaction, in the certainty that there are no faulty methods throughout your entire office organization.

"Here is the Answer"

in WEBSTER'S NEW INTERNATIONAL DICTIONARY

The *Merriam* Webster



Even as you read this magazine you likely question the meaning of some *new* word. A friend asks: "What is *white coal?*" You seek the location of the *Levant* or the pronunciation of *jujutsu*. Who was *Becky Sharp?* Is *Hongkong* a city or an island? etc.

You Often long for a quick, up-to-date, accurate answer. This NEW CREATION is an encyclopedia, equivalent in type matter to a 15 volume set. It answers **all kinds** of questions with **final authority.**

INDIA PAPER EDITION: Printed on **thin, opaque, strong, expensive India Paper** imported for this edition. Has an excellent printing surface resulting in remarkably clear impressions of type and illustrations. What a satisfaction to own the *new Merriam Webster* in a form so light and so convenient to use! **One half** the thickness and weight of the Regular Edition. Weight only 7 lbs. Size 12⅜ x 9¾ x 2½ inches.

REGULAR EDITION: Printed on strong book paper of the highest quality. Weight 14¾ lbs. Size 12⅜ x 9¾ x 5 inches. **Both Editions** are printed from the same plates and indexed.

400,000 Words. 6000 Illustrations. 2700 Pages.
The only dictionary with the *new divided page*,—characterized as "A Stroke of Genius."

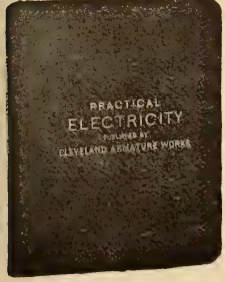
WRITE for specimen pages, illustrations, etc. FREE set of pocket maps if you name this magazine.

G. & C. MERRIAM COMPANY, SPRINGFIELD, MASS., U. S. A.

Per Advt. in Popular Electricity
Send Sample pages, maps, etc.

Name.....

Address.....



A School Within Itself

There are XX chapters in all, XIX carrying you from the fundamental principles of electricity on through the various branches to a point where the careful student comprehends the complete designing, care and operation of a dynamo or motor, and I chapter on electric automobiles, outlining their construction, care and operation, and all about storage batteries and how to handle them. Each subject is carefully written and to the point. After a student studies a subject, he is questioned on that subject in such a manner as to bring clearly to his mind the points he needs to know regarding same. A DICTIONARY in back of book will enable him to learn the meaning of any electrical word, term or phrase used in this book, as well as hundreds of others in common use. All required tables necessary in the study are in it. TABLE OF SUBJECTS:

CHAPTER
I—Wiring.
II—Electric Batteries, Electro Plating.
III—Magnetism.
IV—The Magnetic Circuit.
V—Magnetic Traction.
VI—Magnetic Leakage.
VII—Energy in Electric Circuit.
VIII—Calculation of Size of Wire for Magnetizing Coils.
IX—Calculation of EMF's in Electric Machines.
X—Counter EMF.
XI—Hysteresis and Eddy Currents.
XII—Armature Reaction.
XIII—Sparking.
XIV—Winding of Dynamos and Motors.
XV—Proper Method of Connecting Dynamos and Motors—Self Excitation.
XVI—Diseases of Dynamos and Motors, their symptoms and how to Cure Them.
XVII—Arc and Incandescent Lamps.
XVIII—Measuring Instruments.
XIX—Alternating Current.
XX—Automobiles.

A dictionary of over 1000 Electrical Words, Terms and Phrases, giving a brief meaning of all which are in common use.

$2.00 Per Copy—Sixth Edition—30,000 Copies Sold

The offer we make of refunding money if book is not satisfactory upon examination is AN UNUSUAL ONE in connection with the sale of a book. But we have no fear of its return. Your decision will be what thousands of others have been. Money would not buy it if it could not be duplicated. We could print testimonials by the hundreds. It is best to order and be your own judge of its merits.

CLEVELAND ARMATURE WORKS, 4730 St. Clair Ave., Cleveland, Ohio
Armatures and Fields Wound, Commutators Filled AMERICA'S GREATEST REPAIR WORKS

FREE

This $15 Drawing Outfit

But you must write at once. Offer expires in 30 days. I make this most exceptional great offer only to a limited number of selected students.—Just think of it! A complete, regular Draftsman's $15 Working Outfit with high grade Imported German Silver Set of

INSTRUMENTS—ALL FREE

Be a Draftsman!

Draw $125 to $175 per month at once

There is an urgent demand always for skilled draftsmen. Our companies are issuing calls every day for men to fill positions paying from $125.00 to $175.00 per month. Many positions paying $75 to $100 per week always open. Work is light, pleasant and profitable. Unlimited opportunities for expert draftsmen and designers. Mail coupon for valuable book, "Successful Drafting." It explains how **you** can become a skilled draftsman in a short time. It's free—Just think:

Chief Draftsman **Will instruct you personally**

A most wonderful opportunity for a limited and selected number of ambitious men! For over twenty years I have been doing the highest paying expert drafting work. I am **Chief Draftsman** of a large and well known company. Long ago I saw the urgent demand for practical, trained draftsmen and I organized my practical method for ambitious men whom I trained personally. Each month the demand for practical, trained draftsmen is growing—higher salaries are being paid right along. Never before have we felt the need as we do today for men who **really know** practical drafting—the way I am training my students. At this time I can accommodate a few more men (from the ages of 16 to 40) in my spare time. If you write me **at once** I will send you my book, "Successful Drafting," with full particulars—**all free.** But you must write to me—or send coupon now.

I Guarantee

To instruct you **until competent and placed in a position** at a regular salary, paying from $125.00 to $175.00 per month and furnish you free $15 Working Outfit at once.

FREE Outfit Coupon

Chief Draftsman:
ENGINEERS' EQUIPMENT CO.
Div. 1404 CHICAGO, ILL.

Without any obligation on me, please mail your book "Successful Draftsmanship" and full particulars of your liberal "Personal Instruction" offer to a few students. It is understood that I am obligated in no way whatever.

NAME.....

ADDRESS.....

.....

Earn Big Money at once while Learning at home

Yes, my friend, you can make big money at once right at home from the very start,—as much as **$5 to $10 per day.** I will pay you while learning.

Mail Free Coupon Now

Mail this Free Coupon at once and I will send you my book "Successful Draftsmanship" and full particulars—all FREE.

I will send my book if you write at once, absolutely free—also particulars about my offer to a few ambitious men who want to make from $2,500 to $5,000 a year. No obligations whatever on you in sending the coupon.

Address Chief Draftsman
Division 1404, Engineers' Equipment Co., (Inc.)
CHICAGO, ILL.

In the Home

In the Office

Ozone Made at Home

Westinghouse Electric Portable Ozonizer

THE pure air of the mountain top, sea shore, or that you breathe right after a thunder-storm can now be had every day in the year.

The Westinghouse Portable Ozonizer produces it from the air in your room by the simple turning of a switch.

For one cent the Ozonizer produces enough ozone to purify the air in any ordinary bedroom continuously for ten hours.

Medical authorities find ozone an aid in the treatment of bronchitis, hay fever, chronic middle ear deafness, asthma and other like diseases.

Send for booklet descriptive of this wonderful electrical device and the many uses of ozone.

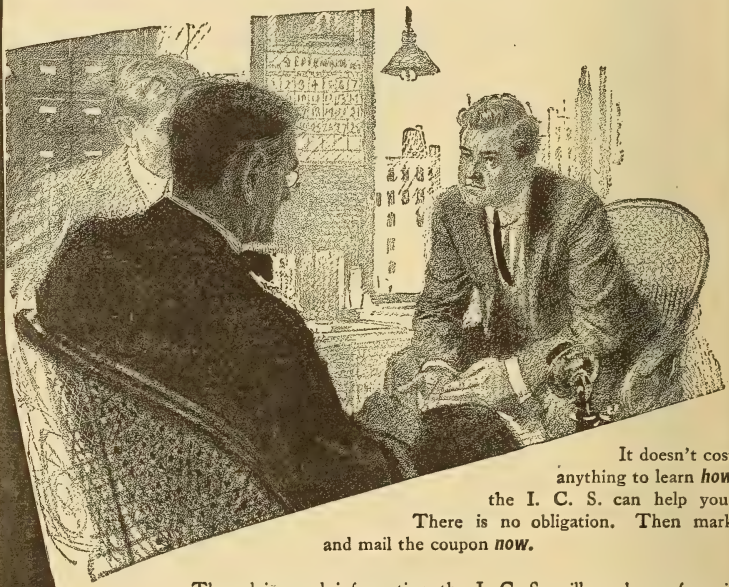
Westinghouse Electric & Mfg. Co.

Dept. OP., East Pittsburgh, Pa.

Are You A Live Wire

In every establishment there are a few men in the "thick" of things, who do the planning. In the ***thin*** of things and trailing off into nowhere are the many who fill the ordinary jobs and who cut but very little figure in the place. ***You*** are in either the ***thick*** or ***thin*** of things. If in the thin, ***switch***—you ***CAN.***

Mark and mail the attached coupon and learn how the International Correspondence Schools can help you become an expert in your ***chosen occupation.*** Doesn't matter who or what you are, where you live, what you earn, or what little schooling you have had, the I. C. S. ***can*** help you.



It doesn't cost anything to learn ***how*** the I. C. S. can help you. There is no obligation. Then mark and mail the coupon ***now.***

The advice and information the I. C. S. will send you free, if you will but mark the coupon, will really open your eyes to far greater success than you ever can achieve without the efficiency the I. C. S. can impart to you ***in your spare time.*** It will surprise you to learn how easy the

For our Mutual Advantage mention Popular Electricity when writing to Advertisers.

in the Business?

I. C. S. can make the way for you, how the I. C. S. arranges terms to suit you, how the I. C. S. is ready night and day—whenever ***you're*** ready, how thousands of other ambitious men owe their ***success in life*** to I. C. S. encouragement and help.

Every month there are ***voluntarily*** reported by I. C. S. students over four hundred salaries raised. This only ***begins*** to indicate how the I. C. S. can help ***you.*** Twenty-one years' of raising salaries the world over proves the ability of the I. C. S.

You're *the man.*

This *is the coupon—MARK IT.*

to raise ***your*** salary, and to make ***you*** a live wire in the business. In other words, the I. C. S. gives you more than mere instruction: it gives you real ***help*** and ***advice,*** based on the actual experience gained in helping thousands of other poorly-paid but ambitious men win success. Are you willing to be shown? Then ***prove*** it by marking and mailing the coupon today. From the moment of marking the coupon you will begin to move from the ***thin*** to the ***thick*** of things.

Mark and mail the coupon ***NOW.***

INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 1102 SCRANTON, PA.
Explain, without further obligation on my part, how I can qualify for the position before which I mark X.

Salesmanship	Civil Service
Electrical Engineer	Railway Mail Clerk
Elec. Lighting Supt.	Bookkeeping
Electric Car Running	Stenography & Typewriting
Electric Wireman	Window Trimming
Telephone Expert	Show Card Writing
Architect	Lettering & Sign Painting
Building Contractor	Advertising
Architectural Draftsman	Commercial Illustrating
Structural Engineer	Industrial Designing
Concrete Construction	Commercial Law
Mechan. Engineer	Automobile Running
Mechanical Draftsman	Teacher
Refrigeration Engineer	English Branches
Civil Engineer	Good English for Every One
Surveyor	Agriculture
Mine Superintendent	Poultry Farming
Metal Mining	Plumbing & Steam Fitting
Locomotive Fireman & Eng.	Sheet Metal Worker
Stationary Engineer	Navigation / Spanish
Textile Manufacturing	Languages / French
Gas Engines	Chemist / German

Name _____

Present Occupation _____

Street and No. _____

City _____ State _____

The Winged Message

Noah's messenger was a dove. In Solomon's time, pigeons were trained to carry messages. Brutus used them at the siege of Modena. They served the Turks in their fights against the Crusaders. In mediæval wars they were more useful than ever before.

France had a carrier-pigeon mail service, with messages reduced by photography and read through a microscope.

Even today carrier pigeons are utilized as news-bearers in isolated parts of Europe.

In America, the land of the telephone, the carrier pigeon is bred only for racing. The winged word has taken the place of the winged messenger.

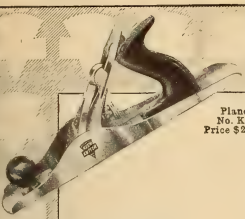
Pigeons may fly more than a mile a minute, but the telephone is as quick as speech itself.

The dove is the emblem of peace. The telephone is the instrument of peace. The telephone lines of the Bell System unite a hundred million people in one national family.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES

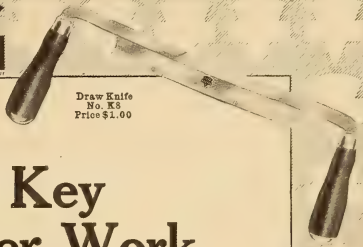
One Policy *One System* *Universal Service*

For our Mutual Advantage mention Popular Electricity when writing to Advertisers.



Plane
No. K5
Price $3.25

E. C. SIMMONS
KEEN KUTTER
TRUE WITH TO CUTLERY FAST OUT TOOLS



Draw Knife
No. K8
Price $1.00

The Key To Clever Work

Plumb Level
No KK30
Price $1.50

Get pleasure and satisfaction from your work—no matter how small the job—by using good tools. They save time and insure perfect results. There is no economy using ordinary tools.

Realize what Keen Kutter tools mean to every man who uses them. They are sturdily built of the finest steel and guaranteed faultless. They last a lifetime under most exacting service.

Hatchet
No. KC 2
Price $1.00

KEEN KUTTER
Quality Tools

have the scientific "hang" and "balance." They do not tire the worker.

Keen Kutter tools always hold their edges. They are tested to the limit and must be absolutely as represented or the dealer is authorized to return your money or give you a new tool. This broad guarantee covers *every* tool that carries the Keen Kutter trade mark, famous for over 45 years.

"The Recollection of Quality Remains Long After the Price is Forgotten."

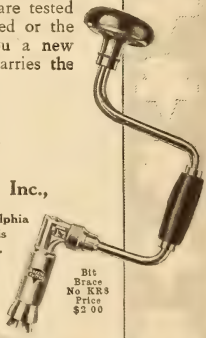
Trade Mark Registered. —E. C. SIMMONS.

If not at your dealer's, write us.

SIMMONS HARDWARE CO., Inc.,

St. Louis, New York, Philadelphia
Toledo, Minneapolis
Sioux City, Wichita.

Hand Saw No. K88 26—26 in. Price $2.00



Bit Brace
No KB8
Price
$2.00

Plane
No. K068
Price $1.75

CLASSIFIED ADVERTISEMENTS

THE COST OF ADVERTISING IN THIS SECTION IS 5 CENTS PER WORD

Remittance must accompany order, or advertisement will not be inserted.

Forms for the May issue close April 1st.

AERONAUTICS

MAKE AN AEROPLANE OUT OF YOUR bicycle for $6.00. Drawings 30c. Thomas Hofmeister, Overlea, Md.

COMPLETE PLAN, DRAWN TO SCALE, with concise Instructions for building a 3-foot Nieuport Monoplane, 25c. Other Plans: Bleriot, 15c, Wright, 25c, Curtiss, 35c, "Cecil Peoli" Champion Racer, 25c. Set of five, $1.00. 40 pp. Model Supply Catalog, 5c. IDEAL AEROPLANE CO., 86B West Broadway, New York.

AGENTS WANTED

$1 SILK TIES, THREE FOR $1, POSTPAID. Unique Novelty Co., Manufacturers, Independence, Iowa.

400% PROFIT. SELLING OUR HIGH grade work. Samples free. Gordon Co., Northwestern Bldg., Chicago.

AGENTS:—SELL $1000 ACCIDENT POLICies, yearly dues $1.00. Your commission 60c. S. Rolfe, 923 N. Alder, Philadelphia, Pa.

PERFECTION POCKET ADDING MAchine—Lightning seller; agents wanted. Cincinnati Specialty Co., Dept. E, Cincinnati, Ohio.

DON'T ACCEPT AN AGENCY UNTIL YOU get my samples and particulars. Money makers. Address SAYMAN, 706 Sayman Bldg., St. Louis, Mo.

AGENTS WANTED TO SELL ARTICLE which can be used in every home and schoolhouse. Non-Draft Ventilator Co., Frankfort, Ind.

MAKE AND SELL YOUR OWN GOODS. Formulas by Expert Chemists. We obtain your Government Serial Number. Catalogue for stamp. E. MYSTIC COMPANY, Washington, D. C.

DON'T ACCEPT AN AGENCY UNTIL YOU get our particulars. Beautiful samples 10c. Write at once to Imperial Art Company, Pomona, California.

WONDERFUL INVENTION JUST OUT, makes what was drudgery, "just fun." Sells for $3.00. Agent pockets half. Big demand. Illustrated circular. Tarbox Coy, Haverhill, Mass.

AGENTS—PORTRAITS 35c, FRAMES 15c, Sheet Pictures 1c. Stereoscopes 25c. Views 1c. 30 days' credit. Samples and catalog free. Consolidated Portrait Co., Dept. 8404, 1027 W. Adams St., Chicago.

AGENTS WANTED

WE HAVE THE GOODS WHOLESALE. Write us. Western Puzzle Works, St. Paul, Minn.

AGENTS WANTED FOR ORIENTAL novelties, never before seen in America. Quick sellers. Repeaters. Immense profits. Joseph Kanematz, Box 529, Portland, Oregon.

AGENTS SELL PALS CHANGEABLE SCARF Pin; make $30 weekly, send stamp for FREE sample Pals Manufacturing Company, 25 East 14th Street, N. Y. City.

GREAT NOVELTIES, LITHOGRAPHED pillow tops 25 cents, cowboy fobs fifteen cents, hat bands seven cents, agents supplies that will bring you money. Rose, 631 Hanover, Baltimore, Md.

AGENTS WANTED TO SELL SALES BOOKS on good commissions in every city in the country. Write for samples and commissions. Chicago Sales Book Company, 158 N. Desplaines St., Chicago, Ill.

AGENTS — THREE NEW FAST-SELLING specialties, first time advertised. Get in quick and skim the cream. Write for particulars. Dickinson Specialty Co., 202-9th St., Milwaukee, Wis.

AGENTS — BIG PROFITS SELLING OUR up-to-date line of household specialties; full particulars, catalogue and samples free. Charles H. Emrich, Box 77, Orwigsburg, Pa.

COMPANION TO THE FOUNTAIN PEN. Agents wanted. Something new. Good proposition. Sample 15 cents. Notae Sales Company, Winter Hill, Mass.

BOKARA DIAMONDS — AGENTS, EVERYone, to wear and sell our famous Bokara diamonds. Write for sample offer and catalogue free. Northwestern Jewelry Co., 1123 Wilson Ave., Chicago.

"I'LL TAKE A BOX." AGENTS, SELL A staple necessity and hear this every few minutes. Big money. Particulars free. Write a postal now, and mail to C. S. Mason, Desk A, Westboro, Mass.

GREAT NEW AGENTS' ARTICLE! "FAMily knife and fork cleaner" made of cork, felt and steel. Sells like wildfire. Dozen postpaid 75c. Sample 10c. Bauer, 135 East 34th St., New York.

ALL ILLS QUICKLY RELIEVED OR CURED through our vibrating regulator. No medicine. Lasts lifetime. $3.00 delivered. Return if dissatisfied. Agents. Supply every home. A. Sasse Company, Pueblo, Colorado.

SIGN AGENTS, PAINTERS 500% PROFIT with our splendid line guaranteed non-tarnishable gold sign letters, trade emblems, make-up-yourself aluminum door-plates. Catalogue, samples, free. Eastern Specialty Co., Dept. 3, 63 Barclay St., N. Y.

GENERAL AGENTS — CAPABLE OF CALLing on the big trade themselves and handling canvassers for the house to house and office to office business, to sell the newest electric specialty on the market; sold everywhere there is electricity in the home, office, factory, store, hotel, liberal profits; sales-driving sample, weighs a pound, no experience or knowledge of electricity required; shows how to use one light instead of two and get the same results; sells for $2.50, $3.50, $5.00 and saves the purchaser an investment of $25.00. Write for particulars. THE HANDY LIGHT CO., 254 Handy Light Block, Cincinnati, Ohio.

AGENTS WANTED

SEE DISPLAY AD, PAGE 57. DOUD LIGHTing Co., Chicago.

SEE WHAT I SAY UNDER "TYPEwriters." ATCHISON.

BURGLAR PROOF DOOR FASTENER — attached instantly to any door without tools. Cannot be picked. Sample and particulars 25c silver. Burglar Proof Lock Company, 435 River St., Dayton, Ohio.

AGENTS AND SALESMEN WILL SECURE FREE, complete information of numerous money-making selling propositions and newest specialties in hands of responsible concerns by addressing DISTRIBUTOR, R. 15, 26 Cedar St., N. Y.

AGENTS MAKE BIG MONEY SELLING our new gold letters for office windows, store fronts and glass signs. Anyone can put them on. Write today for a free sample and full particulars. Metallic Sign Letter Co., 400 N. Clark St., Chicago, Ill.

MANUFACTURER OF GUARANTEED hosiery with linen heels and toes wants agent in every town and city. Re-orders insure permanent, increasing income. Exclusive territory. Credit. Parker Mills, 707 Chestnut St., Philadelphia, Pa.

AGENTS — OUR "HOME LAUNDRY TRIO" are winners. Greatest time and labor savers. Money Makers. Write for attractive proposition—To-day. Leibman, Lefferts Ave., Richmond Hill, N. Y.

AGENTS — MEN AND WOMEN; HOUSEhold necessity, every economical family needs one. Large profits. Stamp brings full particulars. Raymond Company, Box 17, Station H. G., New York.

AGENTS WANTED QUICK. CLEAN LEgitimate money-making proposition. No space for explanations. Write for full particulars and exclusive territory. Krueger Mfg. Co., Dept. 8A, 167 W. Washington, Chicago.

AGENTS. NEW INVENTION SURPRISE to all. A copper magnetic household necessity needed in every home. Big profits. Quick seller. Sample by mail 10 cents. William Lorenz, 1638 So. Broadway, Denver, Colo.

AGENTS—GET PARTICULARS OF ONE OF the best paying propositions ever put on the market. Something no one else sells. Make $4,000 yearly. Send postal to-day for particulars. E. M. FELTMAN, Sales Mngr., 6169 Sycamore St., Cincinnati, O.

WANTED—AMBITIOUS, HUSTLING, TOWN OR COUNTRY MAN in each locality who desires to get ahead and earn more. Part or whole time. Fine chance — Experience not needed. Write quick for Cash-Bonus offer. Box 7E-292, Covington, Ky.

AGENTS — OUR NIGHT WATCH BURGLAR alarm. Explodes a blank cartridge if window or door is tampered with; never fail; big seller. Sample 35 cents. Wedge Mfg. Company, H. Binghamton, N. Y.

WE MANUFACTURE GLASS PAPER. Plain glass windows made to look like real stained glass. Easily applied and beautifies the home. Something new for agents. Two sheets of this glass paper sent as a sample with catalogue in colors and complete instructions on receipt of 10c. S. H. Parrish & Co., 202 S. Clark St., Chicago.

AGENTS WANTED

$2.50 PER DAY PAID ONE MAN OR WOMAN in each town to distribute free circulars and take orders for concentrated flavoring in tubes. Permanent position. J. S. Ziegler Co., 445-B, Dearborn St., Chicago.

BE INDEPENDENT! START A MAIL ORder business in your own home. We tell you how, and furnish everything needed wholesale. An honorable and profitable business for man or woman. Particulars free. Many make $3000 a year. Murphy Mfg. Co., South Norwalk, Conn.

WINDOW LETTER AGENTS. INCREASE your profits. Sell Attracto ready-made Gold and Silver letters — the kind with class to them. 21 styles, easily applied. Sample and catalogue FREE. Attracto Sign Co., 2649 N. Clark St., Chicago.

AGENTS SELL RICH LOOKING IMPORTED 36x68 Rug, $1. Carter, Tenn., sold 115 in four days. Profit $57. You can do as well. Write for selling plan. Sample offer. Exclusive territory. Sample rug sent by prepaid parcel post 98c. R. Condon, Importer, Stonington, Me.

SAMPLE FREE — BOYERS' AUTOMATIC Re-Finisher for Furniture, Store, Bank and Office Fixtures — Finest thing in the World. One application lasts a year. Applied with cheese cloth. Boyer Chemical Laboratory Co., State and Michigan Sts., Chicago.

AGENTS — TO SELL THE NEWEST ELECtric appliance on the market; sold everywhere there is electricity, in the home and office; liberal profits; sales-driving sample, weighs a pound, no experience or knowledge of electricity required; it shows how to use one light instead of two and get the same results; sells for $3.50 and saves the purchaser an investment of $25. Write for particulars. THE HANDY LIGHT CO., 26 Handy Light Block, Cincinnati, Ohio.

500 PER CENT PROFIT—YOUR OPPORtunity. Act how. Buyers everywhere for our U. S. Fire Extinguisher. Low Cost; fast seller; sure profits; exclusive territory. District managers wanted. United Mfg. Co., 1135 Jefferson, Toledo, O.

AGENTS — $200 MONTHLY DISTRIBUTing Newell's needle cases. Sell 115 needles in book for 10c and make 200% profit. Approval Plan envelopes make talking unnecessary. Crew Managers write. Send 10c for sample book and particulars. Newell Company, 509 N. Grand, St. Louis, Mo.

BE AN IND-ELECTRIC REPRESENTATIVE You can make anywhere from $50 to $150 a week selling the *Ind-Electric Health & Beauty Battery* — one of the most remarkable inventions of the decade — a device for which there is a market in every home in America. Our representatives are making this much right now — a few making *more*. You can do the same if you are the right man or the right woman. No special experience necessary. We coach you — tell you of the methods others have used to succeed. With perseverance and enthusiasm you may do as well as our "top-notchers" who are making dandy incomes. We give exclusive territory and let you organize your own sub-agents. Territory being closed rapidly. Write at once to the Ind-Electric Mfg. Co., Desk 18, 432 Peoples Gas Building, Chicago. Capitalization $100,000.

AGENTS WANTED

AGENTS — SAVE TIME AND MONEY. Have your name in our syndicate magazine directory. Big mail for you and the best offers from Dealers and Manufacturers. Special service. Three issues 25c. Results guaranteed. Copy of our magazine 10c. The "LEVER" MAIL TRADER, 449M, Elizabeth, N. J.

WE NEED MORE AGENTS TO SELL THIS wonderful invention, sells at sight for $3.00; costs $1.50. John Peters, without experience, sold twelve in five hours. So can you. You absolutely can't lose. Money refunded on samples without question. Write for free particulars. Spogland Sales Co., 1065 So. Emerson, Denver, Colo.

AUTOMOBILES

FOUR CYLINDER FORD AUTOMOBILE $150. W. Robb, Canal Dover, Ohio.

JUST OUT. GREATEST AUTOMOBILE book, covers every phase of automobile practice. Up-to-date. Circular free. Scientific Book Shop, Syracuse, N. Y.

CHAUFFEURS. SEND FOR FREE SAMPLE copy AMERICAN CHAUFFEUR. Contains valuable information about engines, ignition, carburetion, manifolds, motor balance, cooling and lighting systems, etc. All news of motor world. Every amateur or professional chauffeur should read it. Write now. The American Chauffeur Publ. Co., 252 Butler Bldg., Cincinnati, O.

AUTOMOBILE BARGAINS. LOWEST prices and largest list in the world. All guaranteed, shipped freight prepaid; get my prices before purchasing. Runabouts, Oldsmobile, Reo, Cadillac, $50; Fords, Buicks, $150; Touring cars, Cadillac $90; Reo $150; Buick $175; Winton $275; Pope Toledo $300; Ford $300; Maxwell $275; I have all makes on hand. I desire agents to sell my cars; write for Special Agents' proposition at once. P. E. King, 217 West 125th St., New York City.

AUTO ACCESSORIES

ELECTRIC LIGHT FOR MOTORCYCLES. Storage Battery, built right, $5.00. American Battery Co., 1121 Fulton St., Chicago.

AUTOISTS, NO MORE DEAD ENGINES, OR walks back to town. New discovery. Instructions, 25c. Thomas Mfg. Co., Star Theatre Bldg., Des Moines, Iowa.

CHARGE THE BATTERY YOURSELF. "American" rectifiers—all sizes. Storage batteries—all sizes. American Battery Company, 1123 Fulton St., Chicago.

GUARANTEED 5,000 MILES WITHOUT puncture. If your tires are old, don't throw them away, or you'll throw away $50 to $200. With Durable Treads we give you a written guarantee for 5,000 miles without puncture. This is binding whether your tires are new or old-tread-worn, rim-cut or rut-worn. Durable Treads cost only half as much as tires. Write for booklet and special discount at once to Colorado Tire & Leather Co., 1234 Majestic Bldg., Chicago, Ill., 528 N. W. 34th St., New York City. 435-N Golden Gate Ave. San Francisco, Cal. 1348-N Acoua St., Denver, Colo.

TIRES—ALL MAKES, ALL GUARANTEED. 28x2½ $4.50; 30x3 $6; 30x3½ $13. Write for our complete list of tires and tubes before purchasing. We ship C. O. D. Guarantee Tire Company, Dept. E, 213-219 West 125th St., N. Y. City.

BOOKS AND PERIODICALS

CLASSY BOOKS — STAMP BRINGS CATALogue. Paul Duff, 2713 N. Mozart St., Chicago.

NEW 32 PAGE BOOK FOR GENTLEMEN, send 12c. Curtis Co., E5, Englewood, Chicago.

THREE LITTLE BOOKS FOR LADIES, postpaid, in plain cover, for 25c. (Tell what you want to know.) O. K. Pub. Co., Decatur, Ill.

10,000 FORMULAS, NEW BOOK, 800 PAGES, $3.00. Circular free. P. E. Newnham, Waukegan Ill.

"RHYMES OF DAVID." RACY, RARE, true to nature. One dollar. Fetter Book Co., Robinson, Md.

"TELEPHONE TROUBLES AND HOW TO Find them," 15th edition (56 pages), 25c. Hyde Pub. Co., 183 5th St., Milwaukee, Wis.

WONDERFUL BOOK ON HYPNOTISM, personal magnetism, magnetic healing and occult science sent free to anyone. Send your address today. M. D. Betts, Sta. 129, Jackson, Mich.

ELECTRICAL, MECHANICAL AND practical handbooks, 500 titles. Best prices. Send for circulars. Proctor Book Co., 559B, W. Lake St., Chicago, Ill.

SECOND-HAND BOOKS, HALF-PRICES ON every subject. New 25 per cent discount. Books bought. Catalogue 544 post free. Foyle, 121 Charing Cross Rd., London, England.

IDEAL MARRIAGE: A FASCINATING little book on the sex question. Tells facts everyone should know. Price 25 cents. M. E. Davish, 2481C, 18th St., N-W., Washington, D. C.

A GRAND LITTLE BOOK. "HOW TO Pronounce 10,000 Difficult Words." An authoritative handbook of words in common use, by F. M. Payne, 123 pages bound in Russia with index. Price 50 cents postpaid. Ritchie Pub. Co., 11th Floor, 541 Federal St., Chicago.

"THE GUARDIANS OF THE COLUMBIA" by John H. Williams, just published. Describes some of the grandest scenery on the Pacific Coast. With maps and 210 illustrations (eight in colors). Book 7 x 10½ inches. Cloth binding $1.66 postpaid. Descriptive folder for 2c stamp. N. B. Pearson, 340 East 45th Street South, Portland, Ore.

ELECTRICITY. JUST WHAT YOU HAVE been looking for. Our Modern Blue Print Chart Method of Electrical Wiring Diagrams. Thoroughly explained so that you can easily understand them. All kinds of Bell Wiring, Annunciators, Telephones, House Wiring, Conduit, Theatre, Isolated Plants, Dynamos, Transformers, Arc Lights, Special Treatise on Motor Wiring. Write now for information. ELECTRICAL WIRING DIAGRAM CO., Box B 173, Altoona, Pa.

BUSINESS OPPORTUNITIES

FREE! 75c CERTIFICATE. WM. COX, Waterloo, Iowa.

MAIL ORDER BUSINESS. I START YOU free. E. Newnham, Waukegan, Ill.

BIG MONEY MAILING CIRCULARS FOR others. Send 25c for complete instructions and circulars. Alkan Co., 823 Market St., Oakland, Calif.

BUSINESS OPPORTUNITIES

PARCEL POST SPECIALS, MUSIC, NOVELties, etc. Bargain list free. O. Fink, Pottstown, Pa.

YOUR 25 WORD ADVERTISEMENT IN 125 reliable magazines, $1.00. Globe Exchange, 433 Lexington, New Haven, Conn.

START EARNING $20.00 WEEKLY UPward, mail order business. I co-operate with you. Free plan. Wm. Benke, Dept. 101, Bucyrus, Ohio.

ALARM REFRIGERATOR DRIP-PAN, A new home convenience for $1.50. Agents com. 50%. Address Clarence D. Skinner, Topeka, Kansas.

BIG MAIL!— RECEIVE SAMPLES, CIRCUlars, propositions, Send 20c (coins) for publishing name in Directory. Directory, 1305 Ashmun St., Burlington, Iowa.

$1.00 A WEEK WILL START YOU IN A BIG money-making mail order business with the best line—in spare time. Particulars Free. Nadico Co., 1671 Belmont Ave., Chicago.

ADVERTISERS! MAIL DEALERS. OUR Advertisers' Guide gives rates, circulation of 2,000 Different Publications. Includes 30 Mail Order Plans. Sent complete 10c. Dearborn Advertising Agency, 527 Franklin Bldg., Chicago.

IF YOU WANT TO KEEP POSTED IN THE Mail Order Business, you should have our magazine each month and see how the other fellow is doing it. 10c per copy. Three months' 25c. The "LEVER" MAIL TRADER, 449M, Elizabeth, N. J.

WE HELP YOU RAISE CAPITAL AT ONCE to start you in retail, manufacturing, patent, real estate, mail order or any legitimate business by means of "Our Practical Method." Particulars free. The Business Aid Co., K 508, Detroit, Mich.

HOME MANUFACTURING — PLEASANT and profitable business quickly established during spare time. Product international necessity. Write for sample and particulars. Delzell Mfg. Company, Desk B, 448 South Mathews, Los Angeles, Calif.

MAKE MORE MONEY. BE A VENTRILOquist. Devote your spare time to giving entertainments. Anyone can learn by my method. Complete course about 2,500 words twelve lessons $2.00. Skeels "The Magician," Box P. 445, Storm Lake, Iowa.

SOMETHING NEW — USEFUL FOUR-INone patented article for women. Sells quickly; big profits; high class imprint circulars furnished; single orders filled direct to customers. Sou. Distributing Co., Sales Mgrs., Sta. B-2. Memphis, Tenn.

FREE! CATALOGUE, BEAUTIFUL ART castings, in concrete, plaster, artificial marble, papier maché, composition, marble dust, interior, exterior decorations, garden furniture, statuary, etc. Describing instructions of their manufacture, including making flexible moulds, renovating frame buildings with artificial stone, modeling, coloring, gold leaf gilding-burnishing, paper selecting-hanging. Big profits. Low expense. Little labor. Mahler, 117 Russell St., Brooklyn, New York.

3,000 RECIPES, FORMULAS 40c. ROADman's Guide—100 money-making schemes 25c. Scientific Book Shop, Syracuse, N. Y.

BUSINESS OPPORTUNITIES

WE START YOU IN BUSINESS, FURNISHing everything; men and women, $30.00 to $200.00 weekly operating our "New System Specialty Candy Factories" home or small room anywhere; no canvassing. Opportunity lifetime; booklet free. H. Ragsdale Co., East Orange, N. J.

85c PROFIT ON EVERY DOLLAR, MAKING article at home that nearly everybody buys and uses. A grand business builder for men, women, or boys. Honest, lawful, and easy. Full instructions for dollar bill. Fine picture of President Wilson free to patrons. J. M. Kovats, 701 West 117th Place, Chicago, Ill.

SEE WHAT I SAY UNDER "TYPEwriters." ATCHISON.

AD BARGAINS—25 WORDS IN 100 MONTHlies, $1; 100 weeklies $2. Life Co., St. Louis.

CONDUCT PAYING MAIL ORDER BUSIness from your home: $5.00 Starts business, complete course $1, particulars FREE. Box 115, Brooklyn, N. Y.

MAKE $300 TO $600 A MONTH OPERATING special sales for retail merchants. Complete instructions, $2.00. Address W. R. Humphreys, Box 74, Lexington, Mo.

SICKNESS AND ACCIDENT INSURANCE — Sold direct to the Insured at actual cost. Save the Agent's commission — and know what you get. All occupations, men and women, 16 to 60 years accepted. Are you Protected? We will Insure you. Write for free particulars. The I-L-U 958, Covington, Ky.

STOP! INVESTIGATE AT ONCE! NEW business! No Experience! 500% profit making photos with the new One Minute Post Card Camera. Takes and delivers finished post card photos in one minute right on the spot. No plates, films or dark room. Make big money everywhere, traveling or at home. This is your opportunity for immediate and permanent success. Don't delay! Write to-day for free information. The One Minute Camera Co., Dept. 73, Rand McNally Bldg., Chicago.

EARN $10 TO $15 A WEEK AND HOLD your position besides. No canvassing. We, as manufacturers of patented just-in-season specialties, have new easy Mail Order Plans to keep factories busy. We furnish everything. Large profits. Small capital. Experience unnecessary. If you are one of the want-to-go-ahead kind, write for our most modern (copyrighted) plans. Sworn statement. J. M. Pease Mfg. Co., 550 Pease Bldg., Main St., Buffalo, N. Y.

SUCCESS GUARANTEED. I WILL START you doing work at home evenings; guarantee that you will make $50 to $400 monthly or not charge you for my services. If after following my instructions you do not make $50 after the first month working my method you do not owe me one penny; if, however, you do make the $50 you are to pay me $25 in five installments of $5 each and 2% of your earnings thereafter. Could I make a fairer offer than this? If interested enclose ten cents (to help pay advertising, mailing and printing expenses, but chiefly TO KEEP AWAY CHEAP CURIOSITY SEEKERS FOR WHOM I HAVE THE UTMOST CONTEMPT, and no such person can have my money or valuable time at their disposal if I can prevent it). For full instructions. Joseph K. Leinmiller, 1023-25 Olive St., Phila., Pa.

BUSINESS OPPORTUNITIES

LET THE PARCELS POST HELP YOU. Add ($15 to $25 weekly) to your present salary or income. Start during spare time and build up a permanent mail-order business of your own. We show you how and help you make good. No canvassing. Experience unnecessary. The Parcels Post makes success doubly sure. Our new ideas and up-to-date plans bring the money. No so-called "Course of Instruction" to sell. We give that free. Write to-day. Address Pease Mfg. Co., Inc., Dept. B, 70 Broadway, Buffalo, N. Y.

RESIDENT MANAGER WANTED IN every city and town to open and manage branch office; brand new proposition; Wonder Cloth finds a steady sale in every home, office, store, factory, garage, etc; three big sources of profit—a local, a mail sales and a jobbing business; cash sales; duplicate orders; samples, printed matter and new selling method furnished free; no experience needed; can make up to $5,000 yearly. If you have a few dollars and good reference, write—Bethlehem Utilities Co., Dept. 25, 65 Pine Street, New York.

COINS AND STAMPS

SPECIAL! SEND 13c FOR 6 DIFFERENT Honduras. Acme Stamp Co., St. Louis, Michigan.

FINE APPROVAL BOOKS 60% DISCOUNT 50 different foreign 3c. Pioneer Stamp Co., 1027 East 40th St., Los Angeles, Calif.

STAMPS—100 ALL DIFFERENT, FREE. Postage 2c. Mention paper. Quaker Stamp Co., Toledo, Ohio.

UNITED STATES LARGE CENT 10 DIFferent dates 50c, 10 different foreign coins 15c, 10 old bills 35c. C. Burgess, 522 Beacon, Toledo, Ohio.

STAMPS — ALL KINDS OF STAMPS bought and sold. If an active collector write for free copy of "*Philatelic Opinion.*" Poole, Box 2, Altadena, Calif.

OLD COINS BOUGHT AND SOLD — MY new 50 page fall coin selling catalogue just out. Free to collectors only. Buying coin catalogue sent on receipt of 10c. William Hesslein, Malley Bldg., New Haven, Conn.

"WIRING A HOUSE," BY H. PRATT, shows a house already built; tells you just how to start about wiring it; where to begin; what wire to use; how to run it according to insurance rules; in fact, all the information necessary for wiring a house and shop. Postpaid, 25c. Popular Electricity Book Department.

$100 PAID FOR 1894 DIME S. MINT, $8 FOR certain 1853 Quarters, $100 for certain 1853 Half Dollars. $2 for 1885 Dime S. Mint. $6 to $750 for certain $5 gold without Motto, etc. We pay highest cash premiums on thousands of coins to 1900. Keep all old money and send stamp for Large Illustrated Coin Circular. You have nothing to lose. The Numismatic Bank of Texas, Dept. 5, Fort Worth, Texas.

CAMERAS AND OPTICAL GOODS

WE BUY, SELL AND EXCHANGE. BARgains in microscopes, telescopes, binoculars, cameras, etc. Bargain list sent. Kahn & Son, Opticians, No. 54 John St., New York. Established 63 years.

FOR SALE OR EXCHANGE

3 DRY BATTERIES. 50 CENTS PREPAID. Cornish Electric Co., Schenectady, N. Y.

FLASHLIGHTS COMPLETE, 50c. SEND AT once. R. C. Force, Attica, Ohio.

FOR SALE, PEDIGREED AIREDALES. W. F. Goodin, Columbus, Mont.

SEE WHAT I SAY UNDER "TYPEwriters." ATCHISON.

FOR SALE—4A SPEED KODAK OR EXchange for an electrical instrument. Address 845 Butterworth St., Grand Rapids, Mich.

PATENT FOR SALE. NEW AND USEFUL invention in logging bunks. Good proposition for manufacturers. Address, P. A. & F. J. Anlauf, Curtin, Oregon.

HAT MIRROR — WITH YOUR NAME ON. Latest craze. Sample 10c. Thos. Sullivan, 100 Abbott Ave., Fitchburg, Mass.

40,000 POUNDS LEAF TOBACCO FOR SALE. Mail stamps for samples to Anton Wavrin, Franklin, Ky.

TATTOOING SUPPLIES, MACHINES $2.50. To advertise, 6 colored designs 15c price list free. F. Barber, 1019 Vine St., Cincinnati, Ohio.

CALIFORNIA GEM CRYSTALS AND MINerals for sale direct from the mines. Approval lots sent with good reference. Albert Everitt, Escondido, California.

THE "SNAP-SHOT" SELF-FILLER FOUNtain pen, six extra pen points and bottle of best fountain-pen ink, parcels post prepaid 50c. The "LEVER" COMPANY, 449M, Elizabeth, N. J.

SOMETHING NEW, SANITARY PARAWAX Folding Drinking Cups; postpaid 10c, 3 for 25c. Niagara Falls Novelty Co., Box 765, Niagara Falls N. Y.

SELL OR EXCHANGE—STRONG'S LETtering Course; 6 month's correspondence instruction scholarship unused, make offer. White, 435 West 22d, New York.

FOR SALE. LIGHT MFG. BUSINESS PATents—Stock and tools of a novelty in daily use; can be sold by mail or agents; a good business for a small investment. H. E. Grebner, Beverly, Mass.

COMPLETE SET OF DETAIL DRAWINGS for a ½ H. P. Horizontal Steam Engine. Price, 75c. The Mechanical Plan Company, 1635 Willington Street, Philadelphia, Pa.

TALKING MACHINES AND RECORDS AT cut prices. 100,000 — 10 inch records never sold less than 60 cents. Our cut price 20c each. Send for catalogue. Deninger, North St., Rochester, N. Y.

GET READY FOR TROUT FISHING SEAson. Try my special Scotch trout flies. Made by experienced fly maker who makes specialty of trout flies. 10c or 3 for 25c. D. Thomson, Haines Falls, N. Y.

FOR SALE: TWO ST. JOHNS RIVER front lots 100 x 1,000 ft. near Jacksonville, Fla. Grocery, dock, poultry, fruits, small orange grove, timber, $900. Strawberries by the barrel, May to November; charming lawn ornaments; full details 25c. Art Munson, Gilmore, Fla.

FOR SALE OR EXCHANGE

GREATEST YET. 1,000 FORMULAS 20c. Johnson & Co., Phoenix, Ariz.

EARN $10 TO $25 DAILY. MY BOOK teaches tattooing 25c coin. Machine, ink, and directions 50c coin. Rebec Mfg. Co., Cedar Rapids, Iowa.

GRANDFATHER'S CLOCKWORKS $5.00. Slightly shop-worn, quantity limited, others with chimes, all prices; also several nice grandfather's clock cases, exceptional bargains. Clock Company, 1649 Ruffner St., Phila., Pa.

A PERIODICAL OF HORSE SENSE IS THE Spark Plug. Read by 3,000 good fellows. 20c a year. Your 15 word advertisement and a year's subscription, 25c. The Spark Plug, Lancaster, Ohio.

AT MANUFACTURER'S PRICES. MEN'S and women's raincoats. Stylish and serviceable, in tan or gray. By parcel post $2.85. Money back if unsatisfactory. Give breast measure. Illustrated folder and samples free. B. & J. Rubber Co., 161B Summer St., Boston, Mass.

PLATE YOUR TRIMMINGS WITH BEAUTIful silver. AR-GEN-TOR will do it in one minute. A pure, permanent plate. No cyanide or mercury. None like it, none as good. One box plates any car. Get ready for spring. Now is the time. $1.00 prepaid. Forest City Sales Co., Fremont, Nebr. Dept. 2.

NOW IS THE TIME — YOU ARE INTERESTed in wire as Magnet wire, Norway iron wire and rods, sheets for transformers, platinum, aluminum, brass, and German silver wire. Fibre, hard rubber, asbestos, mica. Raw materials and articles such as every experimenter needs. We can supply almost everything for experimental and model work. Lowest prices, catalog 6 cents, may be deducted with first order of $1.00. Experimenters Supply Co., 125 S. Fifth Ave., Chicago, Ill.

ELGIN WATCHES—$2 A MONTH. WHY not buy your Elgin Watch now while you can get it at a special price and on such easy monthly payments that you'll never miss the money! This month we will sell you a $20, 17 jewel Elgin in 25 year gold case for $16.50 or a fine $30, 17 jewel Elgin in 25 year gold case for only $19.75, no money down, sent subject to your approval. Write for FREE Catalog. We are the largest Watch House in America and trust honest people everywhere. HARRIS-GOAR CO., Dept. 780, Kansas City, Mo.

FOR SALE OR EXCHANGE; B. C. COLUMbia concert graphaphone with horn and tripod with 100 records. Victor No. 111 with horn, 25 disc records; 3 post card vending machines; Business Phonograph, motor driven, full equipment; Writerpress, Planotype, Mimeograph, Double barrelled shot gun, pump gun, Oliver, Underwood & L. C. Smith & Bro. typewriter, Al Vista Panaromic Camera. Everything in good condition. Want small motors, Piano, Victrola, watches, motorcycle, diamonds or anything of value. Add. Jos. P. Weiler, Olney, Ill.

FORMULAS

PRACTICAL FORMULAS: COMPILED BY chemist. Guaranteed. Write, Crain, Ph. G., Chicago Heights, Ill.

FORMULAS

FORMULAS FOR MAKING THE FOLLOWing articles 25 cts. each, silver plating fluid, dustless dust cloths, furniture polish, waterproof harness dressing. Ryonol Co., No. 217 Main St., Dansville, N. Y.

TESTED FORMULAS. HAIR REMOVER, Hair Restorer and Hair Grower, all for 25c. Ellis, 18 John St., Newark, N. J.

FORMULAS AND INSTRUCTIONS FOR manufacturing six big sellers. Sent complete for 10c. Ross, 310½ East 15th St., Kansas City, Mo.

GAMES AND AMUSEMENTS

153 TRICKS AND CATALOGUES. ALL 10c. American, 8Z Judge St., Brooklyn, N. Y.

105 TRICKS, 25c WITH THREE CATALOGS. Klein, 1193 Broadway, N. Y.

"CANADIAN PUZZLE," FEW CAN SOLVE it. Can you? Just try; 10 cents gets it by return mail. C. Charters, 506 Power Bldg., Montreal, Can.

TRICKS, JOKES, PUZZLES, NOVELTIES. Largest assortment in the world. Send 2c stamp for illustrated catalogue. Garfield Novelty Co., 3322 Madison Street, Chicago.

FUN! CACHOO SNEEZING POWDER; STINK ball; Itch powder. Make 'em yourself and sell to others. How—3 formulas for 25c coin. Robt. Knox, Box 784, Savannah, Ga.

PLAYS, VAUDEVILLE SKETCHES, MONOlogues, Dialogues, Speakers, Minstrel Material, Jokes, Recitations, Tableaux, Drills, Entertainments, Make-up Goods. Large Catalog Free. T. S. Denison & Co., Dept. 26, Chicago.

INSTRUCTION

CANDY MAKING — $15 COURSE 50c; CIRcular free. Eagle Co., "D," Quincy, Mass.

LEARN AUCTIONEERING BY CORRESpondence. P. O. Box 72 A, Attica, Indiana.

COMPLETE INSTRUCTIONS FOR RE-charging dry batteries, perfect success, 15c. Wayne Dunbar, Polson, Mont.

BE A DETECTIVE. EARN FROM $150 TO $300 per month; travel over the world. Write to C. T. Ludwig, 201 Scarritt Bldg., Kansas City, Mo.

HYPNOTIZE (PRACTICALLY) "WITHOUT" hypnotic sleep. 16 lessons, $1.00 course, 20c. Publisher, 49½ Clinton St., Albany, N. Y.

SHOW BUSINESS. STAGE INSTRUCTION booklet free. Vaudeville, Drama. Stage Studio, Sta. 17, 249 West 38th St., New York.

INFORMATION ON ANY SUBJECT. ANY question within reason answered 10c each. Geo. Gifford, Jr., 28 West 33 St., Bayonne, N. J.

"HOW TO MAKE PRINTING CUTS"—"200 Formulas," 20c. Publisher, 49½ Clinton St., Albany, N. Y.

FULLY DESCRIBED PLANS FOR THE CONstruction of a dry battery that anyone can make, sent for 25c in coin. R. T. Kalb's Electric Shop, 2631 Sutton Avenue, Maplewood, Mo.

INSTRUCTION

ANYONE WITH MY PATENTED DEVICE and a few hours study can learn practical mechanical drawing. S. Knapp Studio, 236 Jefferson, Detroit, Mich.

LEARN CARD CARVING—A NEW MONEY making art. Beautiful birds, flowers, ships, etc., carved on cards. Easily learned. Send 50c coin for complete instructions and samples, or send a silver dime for beautiful artistic sample. Robt. Knox, Box 784, Savannah, Ga.

YOU CAN DRAW CARTOONS AND COMIC pictures. I teach beginners thoroughly, practically, rapidly. Learn high-salaried, uncrowded profession. Low cost. Details 6c. Ted Hamilton, 209 E. Ontario St., Chicago. Ill.

UNCLE SAM IS A LIBERAL EMPLOYER. Qualify for a Government position. We prepare you by mail for any Civil Service Examination. Many vacancies now exist. Write to-day for free Booklet 49. Capital Civil Service School, Washington, D. C.

LET US TELL YOU ABOUT OUR COURSES of instruction in Electricity.—One is to make you proficient as an electric wirer; the other, a complete course in Electrical Engineering — as good as the courses given in ANY school of Electric Engineering. Maryland Correspondence School, Union Bridge, Md.

OH SAY, CAN YOU RESIST THIS? I CAN show you how to make an Electric Belt with more power than any $40.00 belt on the market — for about $2.00. Finest tonic known for nervousness or weakness in men or women. Complete detailed instructions for dollar bill. You can make big money selling this, too. A. Ritchie, 1113 Morton Block, Chicago.

MAGIC

250 NEW PARLOR GAMES, MAGIC TRICKS, Bargain catalogues, Fountain pen, all for 25c. Particulars free. Johnson's, 112 Viola St., Saint Paul, Minn.

LEARN TO HYPNOTIZE AND MAKE FUN and money. Send for free book to M. D. Betts, Sta. 129, Jackson, Mich.

250 MAGIC TRICKS AND CATALOGUE 10c. Curtis Co., E, Englewood, Chicago.

25 CENTS BRINGS YOU THREE OF THE very latest prepared card tricks and a money making proposition. Skeels, "The Magician," Box P. 445, Storm Lake, Iowa.

MISCELLANEOUS

CYLINDER REBORED INCLUDING PISton and rings 7 in. to 11 in. Sterling Engine Co., 331 S. Clinton St., Chicago, Ill.

LET US SELL YOUR GOODS FOR YOU. We can sell anything going. Ideal Supply Company, Mitchell, S. D.

BROTHER — ACCIDENTALLY DISCOVered Root will cure both tobacco habit and indigestion. Gladly send particulars. F. F. STOKES, Mohawk, Fla.

I WILL START YOU EARNING $4.00 DAILY at home in spare time, silvering mirrors; no capital; send for free instructive booklet, giving plans of operation. G. F. Redmond, Dept. H., Boston, Mass.

MISCELLANEOUS

FREE — FOR 10c TO COVER ADVERTISing, etc., I'll send complete instructions for operating scheme that brought me $2 an hour. (Can swear to this.) If satisfactory remit $1; if not, return. Fink, 4 YMCA, Kane, Penna.

ANYBODY CAN MAKE GOOD CUTS WITH my simple zinc etching process; price, $1.00; specimens and particulars for stamp. T. M. Day, Box E., Windfall, Ind.

DO YOU EXPECT TO ATTEND THE PANama-Pacific Exposition in 1915, at San Francisco? Organizers wanted in every city and town, for the California Travel Club. Two-cent stamp for information, to California Travel Club, 1547 Devisadero St., San Francisco, Cal.

FREE—INVESTING FOR PROFIT MAGAzine. Send me your name and I will mail you this magazine absolutely free. Before you invest a dollar anywhere—get this magazine—it is worth $10 a copy to any man who intends to invest $5 or more per month. Tells you how $1,000 can grow to $22,000—how to judge different classes of investments, the Real Earning Power of your money. This magazine six months free if you write today. H. L. Barber, Publisher, 423, 20 W. Jackson Blvd., Chicago.

MOTORCYCLES

EXCELSIORS, INDIANS, HARLEY-DAVIDsons; also Ford Model N Roadster $275.00. Send for list. R. Callender, 213 Sand St., Peoria, Ill.

MOTORCYCLES, I HAVE ALL MAKES; I can save you dollars, my illustrated catalogue is the largest published, mailed free. Marshes $20 up; Indians $25 up; shipped freight prepaid and guaranteed for six years, send for my lists before purchasing. P. E. King, 213 West 125th St., New York City.

MOTION PICTURE MACHINES

EASY PAYMENTS. MOVING PICTURE Machines, standard size — others $5.00 to $40.00 and all Moving Picture Apparatus, Catalogues. Ralph J. Golsen, 65 East 46th St., Chicago.

WRITE MOVING PICTURE PLAYS; $10 TO $100 each; all or spare time; experience or correspondence course unnecessary. Details free. Atlas Publishing Co., 306, Cincinnati, Ohio.

MUSIC

SHEET MUSIC, LATEST POPULAR HIT, "Don't you Know the People Will Talk." Also that beautiful song, "Always Think of Mother." Big seller. Appeals to everybody. Either number, 15c. W. H. Kessler, Leoti, Kansas.

SONG POEMS WANTED—SEND US YOUR song poems or melodies. They may become big hits and bring thousands of dollars. Past experience unnecessary. Available work accepted for publication. Instructive booklet and information free. MARKS-GOLDSMITH CO., Dept. 21, Washington, D. C.

THREE MASTER KEYS — HOW TO MAKE. One unlocks almost any common door lock, one, any night lock, one, any trunk. Each 25c. Finished keys 50c. each, postpaid. Harbert, Locksmith, 2861 N. Clark, Chicago.

PATENTS

SEE WHAT I SAY UNDER "TYPEwriters." ATCHISON.

WE SELL PATENTS. IF YOU WISH TO add a new product to your line write us. Established 1900. CHARLES A. SCOTT CO., 1086 Granite Bldg., Rochester, N. Y.

SEND FOR FREE BOOKLET, ALL ABOUT patents and their cost. Shepherd & Campbell, Patent Attorneys, 500B, Victor Bldg., Washington, D. C.

PATENT FOR SALE. NEW FEATURES IN concrete wall forms. Best out. Hurry if you want it. Dyhrkopp, Spencer, Iowa.

PATENT YOUR INVENTION. FIRST GET free "Inventor's Primer" with statistical data. Milo B. Stevens & Co., Estab. 1864, 640 F St., Wash.; 351 Monadnock Blk., Chicago.

PATENTS EXPLAINED IN MY FREE books telling what you should know — what to invent — what NOT to invent — how to sell your patent, etc. Write to-day. H. L. Woodward, 901 G Street, Washington, D. C.

PATENTS BRING FORTUNES — OUR FREE Book tells how. Send sketch for Free opinion as to patentability. Best references from inventors of many years' experience. Wm. N. Moore & Co., 508 Loan & Trust Bldg., Washington, D. C.

PATENT SECURED OR FEE RETURNED. Send sketch for FREE EXPERT SEARCH and Report as to patentability. Books on inventions and patents, and reference book, sent free. John S. Duffie & Co., Dept. 2, Washington, D. C.

PATENT YOUR GOOD IDEAS. A DECADE of experience ready to serve you. Trade-marks registered. Write to-day for particulars. George A. Hutchinson, 729 Loan and Trust Building, Washington, D. C.

PATENTS OF VALUE. PROMPT AND efficient service. No misleading inducements. Expert in Mechanics. Book of Advice and Patent Office Rules free. Clements & Clements, Patent Attorneys, 705 Colorado Bldg., Washington, D. C.

THE PATENTOME IS INTERESTING AND instructive. A liberal education in patents and how to get them. Free on request. Established 1865. Anderson and Son, Patent Solicitors, 729 G. St., Washington, D. C.

SEND FOR NEW HELPFUL PLAN FOR inventors and booklet free. Mason, Fenwick & Lawrence, 618 F. Street, Washington, D. C., and New York. Established 52 years. Submit sketch of your invention.

PATENTS SOLD. WE DO THE BUSINESS — not merely collecting advance fees. If you own a valuable patent send for a free booklet. "How we can get cash for Your Invention." No charges made for listing. Patent Advertising & Sales Co., Frankford, Phila.

PATENT BOOKS MAILED FREE—SHOWing 100 mechanical movements invaluable to inventors and mechanics—and telling what is patentable, how to obtain patent or partner, etc. Free on request. Chas. E. Brock, 703 Eighth St., Washington, D. C.

PATENTS

"PATENTS AND PATENT POSSIBILITIES" is a 72-page treatise which tells all about patents, what to invent and where to sell it. It gives honest advice to inventors, and is full of valuable and interesting information. Write for it today! It is FREE H. S. HILL, 929 McLachlen Bldg., Washington, D. C.

PATENT CAPS. FEW INVENTIONS MAKE money. Why? Get interesting story. "My first Invention." Henry C. Thompson, "Invention Adviser," twenty-five years practical experience as inventor and manufacturer patented electrical devices. Not a patent lawyer. May advise against patenting. P. O. Box 3547, Boston, Mass.

FIND OUT FOR YOURSELF WHAT TO invent and how to procure and sell a patent for the same. My book, "Inventor's Universal Educator," covers the matter from A to Z. 140 pages, elegantly bound. Also contains 600 mechanical movements and 50 perpetual motions. Price $1.00, postage free. Money returned if not more than satisfactory. F. G. Dieterich, 654 Ouray Bldg., Washington, D.C.

BUSINESS GOES WHERE IT IS INVITED and stays where it is well treated. For 27 years I have given my personal attention to procuring patents for successful inventors and manufacturers. The opportunity is open to you to get the benefit of the same attention and method of procedure. Write or send sketch. Vernon E. Hodges, 631 Barrister Bldg., Washington, D. C.

PATENT ATTORNEYS

PATENTS WORTH MONEY. FOR BOOKS that tell WHAT patents bring MOST MONEY, and WHY—send 10 cents postage to R. S. & A. B. Lacey, E 52, Washington, D. C., Estab. 1869.

WESTERNERS "BOOST" THE WEST. Patronize Western attorneys. 17 years experience. Several years in Washington. Stephen Giusta, Cooper Block, Denver, Colorado.

PATENT — ADVICE AND BOOKS FREE. Highest references. Best results. I procure patents that protect. Watson E. Coleman, Patent Lawyer, 622 F St., N. W., Washington, D. C.

C. L. PARKER, PATENT ATTORNEY, 915 G St., Washington, D. C. Inventors' handbook, "Protecting, Exploiting and Selling Inventions," sent free upon request.

PERSONAL

GET MARRIED — MATRIMONIAL PAPER containing advertisements marriageable people from all sections, rich, poor, young, old, Protestants, Catholics, mailed sealed free. THE CORRESPONDENT, Toledo, Ohio.

PHOTOGRAPHY

ROLL FILMS DEVELOPED 10 CENTS. Printing post cards 3 cents each. 15 years experience. Send for complete price list. F. C. Hoyt, Sac City, Iowa.

MONEY IN PHOTOGRAPHY. I START amateurs making money at home taking portraits; become professionals. Studio secrets, retouching, etc., fully explained. Wells' Studio, East Liverpool, Ohio.

PICTURES AND POST CARDS

50 DIFFERENT. 10 CENTS. BURT McCann, 321 Newton, Minneapolis, Minn.

PHOTOS. "PRETTY GIRLS" 36 BEAUTY poses 10c. Curtis Co., E4, Englewood, Chicago.

10 PERFUMED POSTCARDS, YOUR NAME in gold. W. Bloomington Co., Bloomington, Ill.

5 PHILADELPHIA VIEWS AND TRIAL membership 10c. International Postcard Club, 130 Wishart St., Philadelphia, Pa.

FRENCH ART PICTURES FROM LIFE models. Catalogue and 8 photos 20c red stamps. L. Nicolas, 109 rue Sainte, Marseilles, France.

POSTALS — JUST GIRLS; 10 NIFTY POSES 10c. 30 — 25c. Bailey, 111 Maple, Napanoch, N. Y.

JUST GIRLS. 25 POST CARDS OF GIRLS, 25c. postpaid. No landscapes. Harold Hartzman, Moline, Ill.

NIAGARA FALLS. POSTAL CARDS, FOLDers, books, views, and novelties. Send ten cents for twenty-two colored views. Agents wanted. American Novelty Co., Niagara Falls, New York.

POSTCARDS. BEAUTIFUL VIEWS OF New York or other cities. Also cards for coloring purposes, 20 for 10c. Carbelle Card Co., 24 E. 21st., N. Y. Room 210.

20 BEAUTIFUL POSTCARDS; GREETING, birthday, best wishes, congratulations, flowers, views, etc. Gold, embossed, etc. 10c. 100 — 40c. Bailey, 111 Maple, Napanoch, N. Y.

MOVING PICTURE POST CARDS — BE UP to date and get the latest thing out. Sample of ten cards 10c. J. L. Wedge Mfg. Co., H. Binghamton, N. Y.

COLLECT POSTCARDS. NAME IN EXchange list and our 20 page magazine 4 months for 10c. Elite Exchange, Dept. E5, 3827 N. 44th Ct., Chicago.

EVER SEE MICHIGAN? NO? PHOTOS are next best. Real photos of winter and summer scenes, six for 30c. List of pictures free. RABY, Norvell, Mich.

PRINTING AND ENGRAVING

BEN FRANKLIN PRINTING OFFICE, COMplete, $1.50. Juron & Co., 1400 Noble, Chicago.

100 6½ INCH GOOD WHITE ENVELOPES neatly printed 30c; 500, $1.25, prepaid. F. A. Johnson, 625 E. 40th St., Chicago, Ill.

GUMMED LABELS. 3000, $1.00. ADVERtising Specialties. Catalogue FREE. MacTaggart, 1233 Arch, Philadelphia, Penna.

ALL FOR $1.10; 100 LETTERHEADS, 100 envelopes, and 100 business cards printed to your order on bond paper. Prepaid. Samples free. Carter Company, State St., Rochester, N. Y.

125 BOND LETTERHEADS AND 125 ENvelopes, white, pink, blue or green, printed, $1 prepaid. Samples. W. Kinnier, Box 206, Brooklyn, N. Y.

GOOD PRINTING AT LOW PRICES. 1000 Good Letterheads, Envelopes, Cards, Billheads, Labels, Circulars, $2.50. Samples Free. Catalogues, Booklets and Circulars our specialty. Ernest L. Fantus Co., 523 S. Dearborn St., Chicago.

RUBBER STAMP

NAME ON RUBBER STAMP, 15c; WITH address, 25c. National Stamp Works, 44 N. Fifth Ave., Chicago. Catalogue.

RUBBER STAMPS AND SPECIALTIES— Most complete line. Send today for my big catalog. Free. Theo. Helbling, 607 Marquette Bldg., Chicago.

SALESMEN WANTED

SALES MANAGER FOR RELIABLE STOCK bond and real estate investment securities house Must furnish references. American Securities Company, Jacksonville, Florida.

SALESMEN WANTED TO HANDLE THE Chase Shock Absorbers for Typewriters. Exclusive territory. Fine opportunity for the right men. The Chase-Dunipace Co., Toledo, Ohio.

REAL ESTATE AND LAND

EIGHT ROOM HOUSE, QUARTER ACRE lot. Good orchard. Situated Uniondale, Pa. For sale cheap to quick buyer. Glenn Tennant, Herrick Centre, Pa.

BUY OIL LOTS IN BRYAN'S OIL SUBdivision in Gulf Coast Oil Belt where fabulous fortunes have been made by investors. We will drill for oil. You get deed to lots, also interest in well. Pipe line crosses tract. Price now $25; terms $2.50 cash and $2.50 monthly for four months; balance $12.50 when paying well is brought in. A few dollars invested now may mean fortune later. Send first payment of $2.50 each for number of lots wanted, or write for particulars before we begin to drill and price is advanced. Address, C. A. Bryan & Co., Owners, 242 First Nat'l Bank Bldg., Houston, Texas.

CYPRESS PARK LOTS ONLY $25. LOcated in beautiful Cypress Park addition, near macadamized driveway, suburb of Houston, fastest growing city in America—has increased from 45,000 to 115,000 population in eight years. 18 railroads, millions going into new skyscrapers, hotels and factories. Government spending millions on Ship Channel, making Houston a Seaport. Fortunes will be made in suburban property. Cypress Park lots offer opportunity of to-day. Only $25 now for fifty-foot lot. $1 cash, balance $1 monthly. Send $1 to-day for choice location or write now for illustrated literature, maps and plats free. Cypress Park Land Co., 416 Commercial Bank Bldg., Houston, Texas.

"ADVANTAGES OF OREGON"— 200 PAGE book giving information on State, amount of Government Land open to entry in each County, General Description of same for what best adapted, Three year Homestead Law, Desert, Timber, Stone, Coal, Mineral Laws, School land in each county with laws, price and instructions how to buy, amount of Government land open to entry in each county in United States with brief description, book 35c. Oregon map in colors showing each United States land district, railroads in operation, under construction and proposed, 25c or both 50c. Edward Nimmo, 11 Hamilton Bldg., Portland, Oregon.

SCHOOLS

SEE WHAT I SAY UNDER "TYPEWRITERS. ATCHISON.

SCHOOLS

DETECTIVES, MEN AND WOMEN, EARN from $250.00 to $500.00 per month. Write for particulars. Interstate Detective School, Peoria, Ills. McDougal Bldg. Suite 26.

WE TRAIN DETECTIVES. YOU CAN BE one. Splendid Opportunities. Travel. Earn $100 to $300 monthly. This fascinating profession taught practically and scientifically by mail at a nominal cost. American School of Criminology, Dept. G, Detroit, Mich.

AMBITIOUS YOUNG MEN AND WOMEN. Prepare NOW for entrance to schools of LAW—MEDICINE — NURSING — PHARMACY and ENGINEERING. Residential or Home-study Courses. UNIVERSITY AFFILIATION. Write *immediately* to BROOKS CLASSICAL SCHOOL, Dept PE, Schiller Bldg., Chicago, U. S. A.

$35 PAYS FOR COMPLETE, PRACTICAL unlimited course in automobile driving and repairing. We have the best, most up-to-date and complete school and shop in the city. Actual experience on various makes of cars. State license guaranteed. Day and evening classes. Call or write. Academy of Automobile Engineering, Dept. C, 1452 Michigan Avenue, Chicago.

TELEGRAPHY

TELEGRAPHY—MORSE AND WIRELESS—Railway Accounting (Station Agency) taught quickly. Railroad Dispatchers' and Western Union wires and complete Wireless Station in school. Splendid opportunities. Graduates assisted. Living expenses low—may be earned. Largest and oldest school—established 38 years. Investment $25,000. Correspondence courses also. Catalog free. Dodge's Telegraph, Railway and Wireless Institute, 16th St., Valparaiso, Ind.

TRADE SCHOOLS

MAKE $5 TO $8 A DAY AS SKILLED ELECtrician, plumber, draftsman, painter, decorator, moving picture operator. We teach you in short time at small expense profitable trade. Free employment bureau places graduates in good jobs. Special limited offer now. Write at once for catalogue and full particulars—no obligations. Dept. 8401, Coyne National Trade School, 51 E. Illinois St., Chicago, Ill.

TYPEWRITERS

STENOGRAPHER MUST SELL HER REMington typewriter, $9.00. Miss King, 2230 Seventh Ave., New York City.

TYPEWRITERS — OFFICE SUPPLIES. Typewriters — All Makes, Lowest Prices. Big volume of business and cash terms enable us to undersell. Smiths, Remingtons, Underwoods, Olivers, etc., at $10 up. Fully guaranteed. Write Young Typewriter Company, 64 W. Madison St., Chicago.

LARGEST STOCK OF TYPEWRITERS IN America. All makes: Underwoods, L. C. Smiths, Remingtons, etc., one-quarter to one-half manufacturers' prices (many less). Rented anywhere, applying rent on price. Write for catalogue 102. Typewriter Emporium (Est. 1892), 32-34 Lake St., Chicago.

TYPEWRITERS

TYPEWRITER BARGAINS, LOWEST prices and largest list in the world, all guaranteed five years and shipped on 15 days trial. Remington $10.00, Smith Premier $10.00, Underwood $20.00, send for our large illustrated catalogue, and special agents offer. Harlem Typewriter Exchange, 213 West 125th St., New York.

I WANT TO CORRESPOND WITH PERSONS who are about to buy a high-grade typewriter, and object to paying the high prices generally asked by manufacturers and dealers. Any make on approval. Catalogue, bargain list and valuable information sent free. A. E. Atchison, 4125 West 21st St., Chicago.

WANTED

WANTED — SIX-INCH INDUCTION COIL. Address: Galpin, Radford, Yukon, Canada.

WANTED, DYNAMOS OR FIXTURES. Clyde Ayers, 3 Rivers, Mich.

WIRELESS

COMPLETE OUTFIT FOR SALE. SENDing 5 miles, receives 50 or more. Price $30. For particulars write H. Faust, 1138 Perk Ave., Reading, Pa.

AIR COOLED SPARK GAPS $1.25. GOOD for any set up to ½ K. W. ¼ K. W. gaps 50c. Vest pocket flashlights, nickel plated case, Eveready Tungsten battery, 69c. All prepaid. Catalogues for 2c stamp. A. W. Bowman & Co., 55½ Sudbury St., Boston, Mass.

HELP WANTED

I WILL START YOU IN THE MAIL ORDER business if you will handle my goods. Crest Company, Atlantic City, N. J.

25c CASH EACH PAID FOR WHISKY drinkers names. Send dime for contract. Horo Company, LeRoy, Mich.

SONG POEMS WANTED—NEW PLAN, BIG money. Free book tells all. Hayworth Music Co., 661 G, Washington, D. C.

MEN AND WOMEN WANTED FOR GOVernment Parcels Post and other Government Positions. $90.00 month. Annual vacations. Short hours. Thousands of appointments coming. "Pull" unnecessary. Farmers eligible. Write immediately for free list of positions open. Franklin Institute, Dep't 52 M, Rochester, N. Y.

AGENTS—LATEST AND BEST NOVELTY. wanted in every home. Send 25 cents for sample B. Wood Novelty Co., Box 656, Portland, Oregon

$250.00 PAID FOR DISTRIBUTING 2,000 free packages perfumed Soap Powder in your town. Reliable men or women. No money required. WARD & CO., 1776 Berteau Ave., Chicago.

$$$$$$$ REPORT LOCAL INFORMATION. Names, etc. to us. Big pay. Enclose stamp. National Information Sales Company, AQJ, Cincinnati, O.

WANTED — FINANCING PARTNER TO help secure patents for valuable inventions. One-half share. Particulars from A. W. McBeth, Steep Creek, Sask., Canada.

HELP WANTED

REPRESENTATIVES WANTED IN EVERY city and town to handle our Handy Stationery Embosser. Sells on sight. No investment. Samples, prices and full particulars for stamp. Miller Sales Company, Dept. H, Lexington, Ky.

WANTED—TEN THOUSAND GENTLEMEN of good taste to try our "FIGOLA" Havana cigar, 25 box $1 prepaid. Beaver Cigar Co., Canton, Ill.

WANTED: COLLEGE GRADUATES IN Electrical Engineering for work in our Testing Departments. Good opportunities for experience and advancement. Apply, Employment P. O. Box 911, Pittsburgh, Pa.

START HOME BUSINESS. SELL YOUR ideas, plans, formulas and knowledge by mail. Some make $1,000 monthly. Instructive booklet for stamp. Information System, 411, Marietta, Ohio.

43 POSITIONS OPEN FOR YOUNG MEN with common school education. Salary good. Send picture of yourself and quarter (to keep out triflers) for application blank. Box 276, Plainfield, Indiana.

FREE ILLUSTRATED BOOK TELLS OF about 300,000 protected positions in U. S. service. Thousands of vacancies every year. There is a big chance here for you, sure and generous pay, lifetime employment. Just ask for booklet S50. No obligation. Earl Hopkins, Washington, D. C.

GET PREPARED FOR MAY 3d RAILWAY Mail Clerk and other Government "exams" by former U. S. Civil Service Secretary-Examiner. Free booklet 94. PATTERSON CIVIL SERVICE SCHOOL, ROCHESTER, N. Y.

INTELLIGENT PERSONS CAN EARN GOOD income at home in spare time copying letters. Fine opportunity, experience unnecessary. Stamp brings particulars. Box 17, Station H. G., New York.

PARCEL POST MEANS THOUSANDS OF Government Positions open to men and women. $75.00 month. Railway Mail Clerk examinations everywhere May 3rd. Write for list positions open. Franklin Institute, Dep't 52 M, Rochester, N. Y.

BIG MONEY WRITING SONGS—WE PAY hundreds of dollars a year to successful writers. Experience unnecessary. Song poems wanted with or without music—will pay one-half of profits if successful. Send us your work today. ACCEPTANCE GUARANTEED IF AVAILABLE. Largest concern in the country. Free particulars. Dugdale Co., Dept. 13, Washington, D. C.

LOCAL REPRESENTATIVE WANTED. Splendid income assured right man to act as our representative after learning our business thoroughly by mail. Former experience unnecessary. All we require is honesty, ability, ambition and willingness to learn a lucrative business. No soliciting or traveling. This is an exceptional opportunity for a man in your section to get into a big paying business without capital and become independent for life. Write at once for full particulars. National Co-Operative Realty Company, H-604 Marden Building, Washington, D. C.

HELP WANTED

AGENTS MAKE BIG MONEY AND BEcome sales managers for our goods. Fast office sellers. Fine profits. Particulars and samples free. One Dip Pen Company, Dept. 4, Baltimore, Md.

JUST OFF THE PRESS—"PRACTICAL APplied Electricity," by David P. Moreton. A book written for practical electrical workers and presented in a practical manner in plain English. Unusually complete, containing 450 pages and 300 illustrations. Price, $2.00. Send for complete description. Popular Electricity Book Department.

To Entertain 311 Jokes and Riddles, 73 Toasts, 91 Parlor Amusements, 21 Puzzles, 15 Tricks with Cards, 7 Comic Recitations, 3 Monologues, 12 Funny Readings, 8 Fortune Secrets, 52 Money Making Secrets. All 10c postpaid.
J. C. DORN, 708 So. Dearborn St., Dept. 50, Chicago, Ill.

Handy Electrical Dictionary

"Just Fits The Vest Pocket"

Designed to meet the needs of the beginner, and at the same time furnish a compact, reliable reference for the electrical worker and expert.

224 pages—"Plain English" definitions of over 4,800 electrical terms and phrases—7 pages of diagrams

Everyone Interested in Electricity Needs it

Price, Cloth, 25c
Full leather, full gilt, 50c

Popular Electricity Publishing Co. Book Dept.
54 WEST LAKE STREET CHICAGO, ILLINOIS

Every Wireless Operator or Amateur Needs This Book

The handiest and most useful Book for the Wireless Operator, Amateur or Professional, ever published.

What It Will Do for You

Contains a complete list of wireless Call Letters, 1500 in all, enabling you to locate the origin of any certain call immediately; also the owner of the station or ship and power rating.

The Morse and Continental Codes are shown on two large full page charts so that they can be read from a distance, also a Beginner's Speed Chart so arranged to assist in learning the Codes quickly.

All the abbreviations used by operators to save time and labor. And last but not least over 100 Hook-ups and Diagrams. No matter what instruments you have you will find a perfect hook-up that works in this book. Blank pages are provided for keeping a record of your own hook-ups.

Price Twenty-five Cents

POPULAR ELECTRICITY BOOK DEPARTMENT
54 W. Lake St., Chicago, Ill.

$867 Buys the Material To Build This Home

Design No. 152-D
Seven rooms and bath, modern, up-to-date interior, a beautiful home, 28x28.

NO MONEY IN ADVANCE

We Save Home Builders 30% to 50%

The Chicago House Wrecking Co. would not dare ship you a carload of building material, valued anywhere from $500 to $1,000 ***without one cent*** down, if we misrepresented one single item. You are perfectly safe, we take all the risk.

No one else in all the world can make such low prices on new Building Material. Our reputation as cash buyers places at our command, first—every bargain worth having. We are satisfied with one small profit—let the in-between profits remain in *your* pocket—*means an immense* saving—that means all previous

Design No. 117
$708 Six Rooms and Bath. A Modern Bungalow, Excellent Interior. Size, 39 feet, 6 inches by 27 feet.

New Building Material Prices S-M-A-S-H-E-D

Then, when our expert knowledge of what to buy and how to buy at the right prices is combined with the expert knowledge of our most complete Architectural Department, the result is practical, modern, beautiful buildings, constructed absolutely without waste—to satisfy all tastes and all pocketbooks.

We not only save you from 25% to 50% on your completed building, but we give you all the assistance you need for its proper and economical construction, free of charge—Blue Print Plans, prepared by expert architects, Specifications and Material Lists, together with ***any other information*** you may need.

Compare our offers and you will be satisfied that none can compete with our price *—and we can equal our service.*

Design No. 55
$743 Six Rooms and bath, all rooms convenient and roomy. Size 22 ft. by 31 ft.

$10,000 BOOK OF PLANS Mail the Coupon Today FREE

A truly wonderful book given away Free. One hundred pages of modern, up-to-date designs. Free to all parts of the United States. Other points upon receipt of 25c.

$2 Brings Complete $50 Set Blue Prints and Specifications for Any of These Beautiful Homes

The object of this advertisement is not to sell plans, but if you are interested in any of the designs shown on this page, we will, to save time, send a complete set of Plans, Specifications and full descriptive Material List, showing sizes, style, quality and catalog number of the material that we furnish. The best part of it is, that the entire $2 will be credited on your order, or if plans do not suit, you may return them and all but 50c will be refunded. In addition, we will also name, upon request, delivered prices for complete Plumbing Outfit and Heating Plant of any kind and furnish complete specifications free of charge.

Design No. 50
$998 Eight Rooms and Bath, very attractive Exterior; Five Closets, Airy Balcony. Size 28 ft. by 28 ft.

FREE Price Wrecking Catalogs

Send for our Special Building Material Catalog No. 101, Plumbing Catalog No. 138 and Heating Catalog No. 120 showing a complete line of construction of house, barn, or any other building. The newest and latest features in each line at low prices.

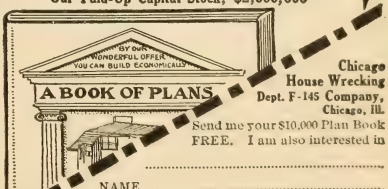
Read Our Guarantee—It Is Your Protection

Our guaranteed proposition to you is to furnish the material as specified in the Material List in ***all brand new stock,*** of the grade, sizes, style, quality and catalog number mentioned, and in quantities sufficient to complete the design strictly according to the plans. We also guarantee prompt shipment of order. All material loaded in one car from our plant here. **Our Paid-Up Capital Stock, $2,000,000**

Design No. 53
$1078 Seven Rooms, Bath, Large Living and Main Bedroom, Modern in every respect. Size 27 x 36 ft.

Heating Plants
Write for our prices on our complete bathroom outfit. We guarantee a saving of 30% to 50%.

Plumbing Material
Steam, Hot Water and Warm Air. Let us estimate on your requirements. Big saving.



Chicago House Wrecking Company, Dept. F-145 CHICAGO

Chicago House Wrecking Co.
Dept. F-145 Company,
Chicago, Ill.

Send me your $10,000 Plan Book FREE. I am also interested in .....

NAME.....

Town.....

County.....State.....

Reaping Rewards from Resolutions

By FRANKLIN O. KING

Do You Remember That Old Story about Robert Bruce and the Spider? Robert was Hiding in a Cave. His Enemies Had Him "In the Hole," Temporarily, So to Speak, As It Were. While Reflecting on the *Rocky Road to Royalty*, Robert, the Bruce, Espied a Spider Spinning His Web Over the Entrance to the Cavern. Nine Times Did the Spider Swing Across the Opening in a Vain Attempt to Effect a Landing, but the Tenth Time he Touched the Home Plate, and Robert, admiring the Persistence of the Insect, Cried Out Loud—"Bravo," Two or Three Times, One Right After the Other. Shortly After That Bruce Got Busy and Captured a Kingdom.

All of This Preamble is Intended to Point a Moral, which is—"If At First You Don't Succeed, Slap on More Steam, and Sand the Track." In This Connection I want to Inquire about Your New Year's Resolutions, and to Ask If You Have Kept the Faith, and If Not—Why Not? *I Believe the Pathway to Prosperity is Paved with Good Resolutions. Therefore, let Us Resolve, and Keep Resolving until Victory is Perched on our Banners.* Remember, You Have Fought Many a Victorious Waterloo that the World Knows Nothing About. The Man who Gets Up every Time He Falls Down Will Some Day Cease to be a "Fall Guy." *Good Resolutions Will be Rewarded with Rich Realizations*, and It Shall Follow as the Night the Day.

Two Texas Gulf Coast Products

How Much Better Off are You than Last Year, or the Year Before That? Perhaps Your Wages are a Little Higher, but Have not Your Expenses More than Kept Pace with That Increase? Aren't You Paying a Little More for Your Clothes and Your Meals, and don't You Smoke More Expensive Cigars and more of Them than Formerly? If it isn't Cigars, It may be Something Else—Some More Expensive Habit.

A Man Begins To Go Down Hill at Forty, and the time may come when a Younger Man—perhaps a *Cheaper Man*—will fill your job. The Man Who-Looks-Ahead will prepare himself for that time by getting a Home. My advice to You, therefore, is to Get a Home while you are able to do so—and Begin Now. I would further advise you to Get a Home in the Gulf Coast Country of Texas.

Since Investigating Conditions in the Rain Belt of Gulf Coast Texas, I have no Fear of Old Age or Poverty, because I know I can Take up a Few Acres down there and be *Absolutely Independent.* I am Firmly Convinced that with *Average Intelligence* and *Average Industry*, any Man who is now Working His Head off in the North to make a Bare Living, where they Snatch One Crop between Snowstorms and Blizzards, can soon Lay Up a Nice Bank Account in the **Winter Garden of America.** Come to the *Land of Least Resistance*, where You can Grow Three Big Money-Making Crops a Year on the Same Soil and Without a Dollar's Worth of Expense for Irrigation or Fertilization.

I believe you could save Twenty-Five Cents a Day if You Tried. I know you would Try if you Realized that our Growers of Figs, Strawberries and Early Vegetables clear a net profit of $300 to $500 an Acre. Men have Realized more than $1,000 an acre growing Oranges in our Country. Remember that our Early Vegetables get to Northern Markets in Mid-Winter and Early Spring, when they command Top Prices.

One German Truck Grower on adjoining lands last spring realized nearly $500 from three-fourths of an acre of Strawberries. You could do as well if you only Tried, and on a Ten-Acre Tract **Find Financial Freedom.**

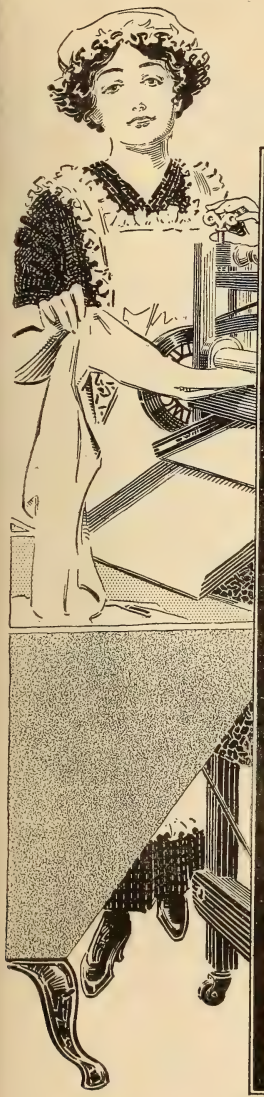
The Biggest Price paid for a car of watermelons on the Houston Market last year was $140. The car was shipped by the Danbury Fruit and Truck Growers' Association.

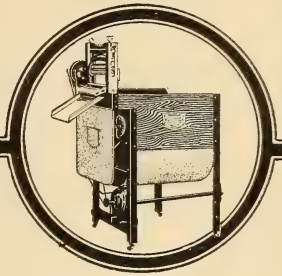
We are situated within convenient shipping distance of Three Good Railroads and in addition to this have the inestimable Advantages of Water Transportation through the Splendid Harbors of Galveston and Velasco, so that our Freight Rates are Cut Practically in Half. The Climate is Extremely Healthful and Superior to that of California or Florida—Winter or Summer—owing to the Constant Gulf Breeze.

Our Contract Embodies Life and Accident Insurance, and should You Die or become totally disabled, Your family, or anyone else You name, will get the Farm without the Payment of Another Penny. If you should be Dissatisfied, we will Absolutely Refund your Money, as per the Terms of our Guarantee.

Write for our Free Book, which contains nearly 100 Photographs of Growing Crops, etc. Fill Out the Blank Space below with your Name and Address, plainly written and mail it to the Texas-Gulf Realty Company, 1448 Peoples Gas Bldg., Chicago, Ill. Read it Carefully, then use your own Good Judgment.

Please send me your book, "Independence With Ten Acres."





The Federal Electric Washing Machine

Soon Pays for Itself

Consumes no more electricity than three ordinary 16 power candle lamps—scarcely noticeable on a lighting bill. If you pay your washer woman $2 weekly, then the new *Federal* will more than pay for itself within a year, and will thereafter save you money every week. Besides this, it saves wear and tear on clothes. Both Washer and Wringer operate by electricity. Save money—save time—strength and your clothes.

The price of the *Federal* is $85. We will ship this improved Washer anywhere in the United States on the guarantee that it may be returned if it does not give perfect satisfaction.

Write today for complete information.

ELECTRIC SHOP

Michigan and Jackson Boulevards

CHICAGO

Throwing Money Away

Is no worse than paying the market price for an article of inferior quality

Our 1913 Model "D" Suction Cleaner

Is 99 per cent perfect

It has all the kinks taken out
It represents the process of elimination

It stands for
Simplicity
Durability
and
Thorough Efficiency

There are no "Kumbacks." You take no chances and make no mistake in sending us a trial order.

We are so sure of model "D" that we sell it at

Our Risk of Making Good

Additional Attachments for Cleaning, Bedding, Drapery, Furniture, Clothing, etc.

AGENTS

Some good territory still available. Best season for sale of Cleaners just opening. Exclusive and remunerative agency proposition. *Write today.*

MODEL "D"
Cleaner
The Most Highly Developed Sanitary Suction Cleaner Ever Made

Efficiency Increased 100% by our New Device for raising or lowering the nozzle to suit the thickness of the Rug or Carpet.

BIRTMAN ELECTRIC CO., Chicago, U. S. A.

MANUFACTURERS OF
LABOR SAVING ELECTRICAL UTILITIES

EDWARD P. RUSSELL WALTER S. BREWSTER C. L. PENISTON

RUSSELL, BREWSTER & CO.

Successors to
EDWARD L. BREWSTER & CO.

BANKERS AND BROKERS

116 W. ADAMS STREET
CHICAGO

New York Office
111 Broadway

Members New York Stock Exchange
Chicago Stock Exchange

We recommend to investors the following high-grade Preferred Stocks and Bonds

Public Service Company of Northern Illinois

*FIRST AND REFUNDING MORTGAGE 5% GOLD BONDS.
Due October 1st, 1956. Interest payable April 1st and October 1st.
Price to net better than 5%

*6% CUMULATIVE PREFERRED STOCK.
Tax exempt in Illinois. Earnings largely in excess of dividend requirements. Interest payable quarterly.
Price to net nearly 6%
* Listed on Chicago Stock Exchange.

Illinois Northern Utilities Company

FIRST AND REFUNDING MORTGAGE 5% GOLD BONDS.
Due April 1st, 1957. Interest payable April 1st and October 1st.
Price to net better than 5%

6% CUMULATIVE PREFERRED STOCK.
Tax exempt in Illinois. Dividends payable quarterly.
Price to net nearly 6½%

United Light & Railways Company

FIRST AND REFUNDING MORTGAGE 5% GOLD BONDS.
Due June 1st, 1932. Interest payable June 1st and December 1st.
Price to net better than 5½%

6% CUMULATIVE FIRST PREFERRED STOCK.
Earnings nearly three times dividend requirements. Dividends payable quarterly.
Price to net nearly 7%

Federal Sign System (Electric)

7% CUMULATIVE PREFERRED STOCK.
Earnings more than double dividend requirements. Dividends payable quarterly.
Price 100 and accrued dividends, with a bonus of 25% Common Stock Voting Trust Certificates.

Middle West Utilities Company

6% CUMULATIVE PREFERRED STOCK.
Carries a bonus of 25% of common stock. Dividends payable quarterly. Price to net better than 6¼%.

We shall be pleased to furnish circulars regarding the above or give further information on these and other securities. Correspondence invited.

It will pay to Read These Advertisements

Because they are small you should not pass them over. The good things in life are worth looking for and many of the smaller advertisers have worthy products which they can sell you although many of them are not in a position to buy large space to tell their story. We bespeak your patronage for these advertisers.

POPULAR ELECTRICITY MAGAZINE

Small Ad Department

BILLIARDS AT HOME

Have your own Burrowes Billiard and Pool Table. A few cents per day will buy it. No special billiard room needed. Write for particulars.

THE E. T. BURROWES CO. 127 Free St., Portland, Me.

Young Man I Want You

Would you take a steady job selling my quick moving, snappy line of soaps, perfumes and toilet preparations? No experience needed. I pay cash; no premiums. If you are looking for an unusual opportunity for making **big money quick** write me a postal saying, *"Mail full particulars."* *Address* **E. M. DAVIS, President**

E. M. DAVIS CO., A 177 Davis Block, Chicago

Do Your Printing!

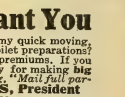
Cards, circulars, books, newspaper. Press $5, Larger $18, Rotary $60. Save money. Big profit printing for others. All easy, rules sent. Write factory for press catalog, TYPE, cards, paper, outfits, etc. THE PRESS CO., Meriden, Conn.

Covill's Celebrated Watch Insulator.

TRANSPARENT COVER KEEPS OUT ALL DIRT

Send 25c for sample, also size you want. 12, 16 or 18 size, Hinge or Screw.

Also: 17 Jewel Elgin Watch, Waltham or Illinois, $10.95, with 20 year filled case.



Sent C. O. D., subject to examination.

W. J. COVILL, 62 State St., Rochester, N.Y.

TYPEWRITERS ALL MAKES

$100.00 Underwoods, Smiths, Olivers, Remington, etc., from $10.00 up. Every machine in perfect condition, guaranteed two years, with privilege to exchange at any time. 300 typewriters at $15.00 each, while they last. Write for our cut rate prices and Free Trial Offer.

All Makes Typewriter Exchange Co. 166 N. Dearborn St., Chicago, Ill.

WHITE VALLEY GEMS IMPORTED from FRANCE

SEE THEM BEFORE PAYING!

These gems are chemical white sapphires—**LOOK like Diamonds.** Stand acid and fire diamond tests. So hard they easily scratch a file and **will cut glass.** Brilliancy guaranteed 25 years. All mounted in 14k **solid gold diamond mountings.** Will send you any style ring, pin or stud for examination—all charges prepaid—**no money in advance.** Write today for free illustrated booklet, special prices and ring measure.

WHITE VALLEY GEM CO., 742 Saks Bldg., Indianapolis, Ind.

Avoids Mistakes and Saves Brain Work

For General Office or Personal Desk

Over 60,000 in use
Mostly sold through Recommendation

Buy from your Stationer or order direct

Price includes handsome Morocco case. Every machine guaranteed Money refunded if not satisfactory after 10 days trial

Sales Agents Wanted

P. E. Gancher A. A. M. Co. 315 Broadway N.Y.

Fobs and Badges

of all kinds for organizations or personal use. Special designs and letterings. Estimates furnished. Complete catalog mailed on request.

SPECIAL OFFER—This beautiful fob, rose gold finish (retail value 75c) sent postpaid for only 25c.

JONES-VERZIER MFG. CO.
4441 Broadway New York

TYPEWRITERS FACTORY REBUILT

Remington No. 6—$25. Smith Premier No. 2—$23.

Only two of our special bargains. Have trademark and guarantee like new machines. Are thoroughly rebuilt and perfect in appearance. Satisfaction guaranteed. We can save you $25 to $75 on any machine. Branch stores in leading cities.

Write for "The Typewriter's Confession" and catalog.
AMERICAN WRITING MACHINE CO., Inc., 345 Broadway, N. Y.

Guaranteed Non-Magnetic

This watch, a handsome **stem wind** and **set, thin model, dust proof** time piece, will **positively withstand all magnetic attractions.** Tested to 2000 Volts. Guaranteed accurate. Money back if not as represented. Approved by all electrical engineers. Price only $5.00. Delivery FREE

Great Bargains in Diamonds and Jewelry of all kinds

E. KIRCHBERG, 134 NORTH STATE ST., CHICAGO

Our Smart Cards in Case

A PEERLESS CARD

Just what the name implies—Peerless, unapproached, unequaled, unrivaled, is an accurate description of the **Peerless Patent Book Form Cards**

They are more than a card; they are an expression of personality, individuality. They are not only better, but they represent actual economy, because they eliminate waste. Being in book form, every card is used just when detached. They are always flat, unmarred and clean, and all the edges are perfectly smooth and sharp. They can only be appreciated by being seen and used. Send today for a sample tab and detach the cards one by one as you would use them. Their perfection will thrill you.

Established 1857, **The John B. Wiggins Company**

Engravers, Plate Printers, Die Embossers. 86-88 East Adams Street, Chicago

For our Mutual Advantage mention Popular Electricity when writing to Advertisers.

FREE $1,000,000 Worth of Elegant Silverware

and Big Book of 5,000 Bargains in Home Furnishings--Send the Coupon

This magnificent silverware is of warranted quality and made by the celebrated house of Wm. Rogers & Co. You can get anything you want in silver, absolutely without cost. Write quick for illustrated circular from which to make your selection.

From Forest to Factory Direct to You

Our business has reached the enormous size where we own and operate our own forests, lumber mills, railways, factories, warehouses. Our manufacturing cost is the lowest on record. You get the direct and entire benefit. Not one middleman gets a profit. You buy of us at

Prices Lower Than Dealers or Mail Order Houses Can Buy For

Just look at the prices of the 3 articles illustrated and remember these are goods of good dependable quality.

Name.....

R.F.D. or Street.....

Town.....

State.....

Send me, postage prepaid, your Big Book of 5,000 Bargains in Home Furnishings and full information regarding your gifts of Free Silverware to your customers.

LINCOLN, LEONARD & CO.
1460 37th St.
CHICAGO, ILL.

FREE TO YOU

IF YOU ANSWER THIS ADVERTISEMENT

Mail the coupon right now for our Bargain Book and circular from which to choose your free silverware. Don't give yourself a chance to forget!

30 Days' FREE Trial—

C.O.D. if Desired—Everything you order of this great house must absolutely satisfy. We *guarantee* satisfaction. Send cash with order, or one-fourth with order, balance C.O.D. Keep the goods 30 days. Use them, enjoy them, test them. If you aren't fully pleased, return and we'll refund all you've paid and transportation charges both ways. Already we have 1,000,000 satisfied customers. You'll like the Lincoln, Leonard prices, merchandise and silver. Send us your name on the coupon *today*. Fill it out *right now*.

LINCOLN, LEONARD & CO. 1460 37th St. CHICAGO

Largest exclusive distributers of home furnishings in the world [26]

Furniture On Credit

Write for Mammoth Bargain Book picturing 4,782 articles

SPIEGEL, MAY, STERN CO.
1097 West 35th Street, Chicago

INDIA KARACHI BEST OPPORTUNITY

Do you want a good connection with India in the lines you manufacture? Send your lowest quotations and samples to the

EASTERN ELECTRIC & TRADING CO. KARACHI

BUY YOUR FURNACE $10 DOWN $10 A MONTH

Our monthly payment plan of selling direct saves you the dealer's profits and excessive charges for installation. The

JAHANT FURNACE

with the patented "Down Draft System" is best for residences, schools, hotels, churches, etc., because it delivers plenty of heat wherever and whenever desired, at a saving of 1-3 to 1-2 in fuel bills. Install the Jahant yourself. We send complete outfit, freight prepaid with special plans, detailed instructions and all necessary tools for installation. Satisfaction guaranteed or money refunded.

Write for free illustrated book.

THE JAHANT HEATING CO.
153 Mill Street Akron, Ohio

Save 1/3 to 1/2 on Fuel Bills

GENUINE Perfect Cut DIAMONDS BASCH Guaranteed $97.50 PER CARAT

The Only Way to buy a Diamond

is at the BASCH **Price**—protected by the BASCH Money Back Guarantee.

The BASCH Price—$97.50 per carat for Genuine, perfect Cut, pure and brilliant diamonds, has been made possible by *direct importing*, enormous sales, cash methods, elimination of all losses, and low expenses. *We save you 40% below the retail price of jewelers.*

The BASCH Plan enables you to *see* any diamond before deciding on its purchase. *Send us money!* Just write us to ship any diamond and mounting on *approval* at our expense without obligating you to buy. We pay every expense whether you buy or not.

"See that your Diamond is BASCH Guaranteed"

The BASCH Guarantee is a Contract in writing to refund the full purchase price less 10% *in cash!* to accept your diamond at the full purchase price in exchange at any time! The *carat weight, quality, and value* of every diamond is legally guaranteed! All 14k solid gold mountings priced at *cost!*

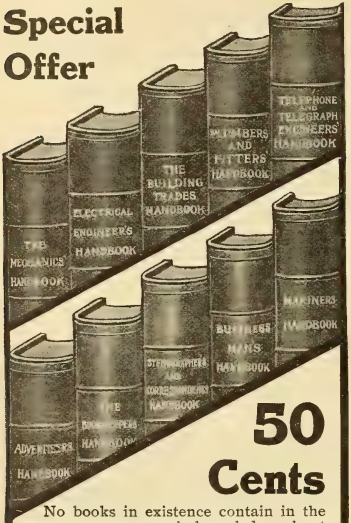
Send for the New 104-page BASCH Diamond Book FREE!

Designs and illustrations of the latest styles in Diamond jewelry, platinum gold and silver jewelry, watches, silverware, etc., at the world's lowest prices—tells you how to buy diamonds intelligently, direct from the Importer. WRITE NOW!

L. BASCH & CO., Diamond Importers Established 1879 **Dept. G353** 5 State St. Chicago, Ill.

For our Mutual Advantage mention Popular Electricity when writing to Advertisers.

Special Offer



50 Cents

No books in existence contain in the same space so much knowledge about the different trades and professions as do the I. C. S. Handbooks. They are compiled from the Courses of the International Correspondence Schools, of Scranton, Pa., which have been written by the best experts in the country. These little books are, therefore, consulting experts of the highest rank—pocket memorandas of inestimable value to the executive, foremen, and managers. They are invaluable as promotion gainers for ambitious men in subordinate positions, because they can be easily understood without a knowledge of higher mathematics, and contain just the information needed by men to secure promotion.

SPECIAL OFFER:—For a limited time we are selling these Handbooks, durably bound in cloth, with gilt titles, containing on an average of 375 pages and 175 illustrations, regularly sold for $1.25, at a price for each Handbook of 50c.

Send the Coupon NOW!

International Textbook Company
Box 1102, SCRANTON, PA.

I enclose $_____ for which please send me the Handbooks BEFORE which I have marked X.

____Mechanics'	____Advertiser's
____Electrical Engineer's	____Bookkeeper's
____Building Trades	____Steno. and Corr.
____Plumbers and Fitters'	____Business Man's
____Tel. and Telegraph	____Mariners'
____Concrete Engineer's	

*Name*_____

*St. & No.*_____

*City*_____ *State*_____

Electrical Engineering

If you could only realize that this offer places within your reach the results of the experience, exclusively published, of scores of America's most able electrical engineers!

ELECTRICAL ENGINEERING is a great monthly technical magazine for electrical engineers of responsibility. The next 24 issues will bring you over 1000 pages, covering every phase of electrical work. A veritable encyclopedia. Not a cheap, common or inferior article ever appears.

WHAT 1c. A WEEK WILL DO!

Only $1.00 buys ELECTRICAL ENGINEERING for two years, and copy "Electrical Engineers' Handbook," 414 p., 238 illus.; one of the most valuable hand books ever published at any price.

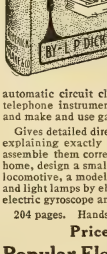
Or $1.50 buys ELECTRICAL ENGINEERING 2 years and "Questions and Answers on the National Electrical Code," 232 p., 4x6¾ inches. This book is just out. It is by an authority. It tells exactly and plainly what the code requires for every job.

$2.00 buys both books and ELECTRICAL ENGINEERING for two years; the best bargain ever bought, but MONEY BACK IF YOU ASK IT.

This offer will not be accepted through news companies or agents. Old subscribers may take advantage of it by extending their subscriptions two years.

ELECTRICAL ENGINEERING
GRANT BUILDING, ATLANTA, GA.

60 EXPERIMENTS IN ELECTRICITY



For the Amateur or Experimenter

Written in simple, easily understood language, fully illustrated with cuts and working drawing.

This is one of the most valuable works ever published.

Presents a wonderfully interesting and entertaining series of electrical experiments, giving full directions for constructing apparatus required with inexpensive materials and tools easily obtained.

Shows you how to make all kinds of batteries, electric bells, rheostats, condensers, large and small induction coils, an electrophorus, an automatic circuit closer, how to construct and use telegraph and telephone instruments, measure electrical resistance and pressure and make and use galvanometers and voltmeters.

Gives detailed directions for building a 1-20 horse power motor, explaining exactly how to make each of the various parts and assemble them correctly. Shows you how to do electro-plating at home, design a small dynamo, build an electric engine, an electric locomotive, a model fire alarm telegraph, make simple arc lamps, and light lamps by electricity. Also how to make an electric bomb, electric gyroscope and other electrical toys, etc., etc.

204 pages. Handsomely stamped cloth covers.

Price Only $1.00 Postpaid

Popular Electricity Book Department
54 West Lake Street Chicago, Ill.

For our Mutual Advantage mention Popular Electricity when writing to Advertisers.

DIAMONDS-WATCHES ON CREDIT

This Elgin Watch, 17 Jewels, Adjusted,

Men's 16 Size, *(also Ladies' 0 Size)* **Thin Model, New Marginal Minute Dial, in Gold Filled Case, Guaranteed for 25 Years, plain polished or handsomely engraved, sent prepaid on**

30 DAYS FREE TRIAL

Then $2.50 a Month

Our cut price of $25.50 for this magnificent Elgin Watch, that will pass Railroad Inspection, is the greatest bargain ever heard of. **NO MONEY DOWN** — $2.50 a Month after examination by you. Whether you are a railroad man or not, this is the Watch you want. No matter where you live, we will trust you. **Send us your order today.** Write for our free Catalog; over 2,000 illustrations of Diamonds, Watches, Jewelry, Silverware, etc. It tells all about our easy credit plan. Write today.

Our Great Special

Loftis "Perfection" Ring

Finest pure white Diamond

$48 TERMS **$4.80 A MONTH**

Other sizes and styles at $25, $75, $100, $125. See our Catalog. Sent FREE.

No. 363

LOFTIS BROS. & CO.

THE OLD RELIABLE, ORIGINAL DIAMOND AND WATCH CREDIT HOUSE

Dept. M871 100 to 108 North State Street, CHICAGO, ILL.

Branch Stores: Pittsburgh, Pa., and St. Louis, Mo.

Guaranteed 25 Years

No. 364

AGENTS

SALESMAN
MANAGERS
YOUNG OR OLD
NEW BUSINESS

STOP A MINUTE READ

DROP THE DEAD ONES. AWAKE! START WITH THIS NEW INVENTION THE 20th CENTURY WONDER

Get started in an honest, clean, reliable, permanent, money-making business. Sold on a money-back guarantee

The Blackstone Water Power Vacuum Massage Machine

For the Home. No Cost to Operate. Lasts Life-Time

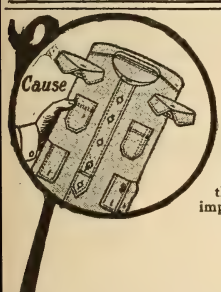
LISTEN No Competition, New Field, New Business. Price within reach of all. That's why its easy to sell. Endorsed by Doctors and Masseures. Removes Blackheads, Pimples, Wrinkles, rounds out any part of the face or body, brings Back Natures beauty. Almost instant relief can be given all kinds of pains such as Rheumatism, Headache, Backache, Neuraliga, and many times a permanent cure. A demonstration convinces the most skeptical person. Sales easily made.

Read On! What Others Do, So Can You.

Parker writes, sold eight machines first day. Margwarth, says, I am making $19.00 per day. Schermerhorn, eight dozen machines first month. Shafer writes, am selling four out of five demonstrations. Vaughn, orders one dozen, four days later wires "ship six dozen by first Express." Lewis, sells four first hour. Men, women, everybody makes money. No experience necessary. Protected territory to active workers. We own all patents. Big book entitled, **"The Power and Love of Beauty and Health" Free.** Investigate now, today. A postal will do. **A big surprise awaits you. Address, BLACKSTONE MFG CO., 679 Meredith Bldg., TOLEDO, OHIO**

AGENTS

GENERAL AGENTS
ROAD MEN
MAKE MONEY HERE
START NOW—TODAY



The Cause and *One* Result

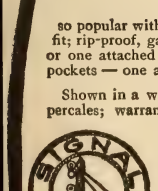
Spend less money for shirts—get greater comfort, longer service, bigger value, by wearing Signal Coat Shirts. They outlast any shirt at the same price—$1.00—and no shirt at any price combines so many comfort improvements. Besides the easy-on, easy-off coat style which makes

SIGNAL $1 COAT SHIRTS

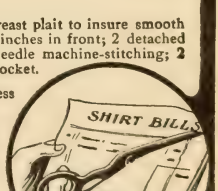
Union Made Two detachable collars

so popular with railroad men, they have an extra button at bottom of breast plait to insure smooth fit; rip-proof, gap-proof sleeve-slit; regular dress cut skirts overlapping 3 inches in front; 2 detached or one attached collar as desired; buttonholes for white cuffs; double-needle machine-stitching; 2 pockets — one a Triple combination pencil, watch and handkerchief pocket.

Shown in a wide variety of pleasing patterns in fast color, skrinkless percales; warranted for wear and union made.



Sent at our Risk. Ask your dealer. If he hasn't them, tell us his name and your size and we will express a couple C. O. D. If not delighted with them on examination. return *at our expense.*

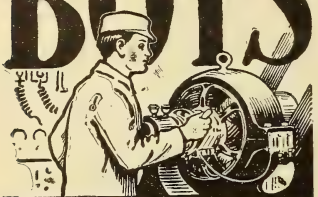


Hilker-Wiechers Mfg. Co.,

Manufacturers of SIGNAL Work Clothes

1248 Mound Ave. Racine, Wisconsin

BOYS



Big Money in Electricity

The electrical field affords a wonderful opportunity to boys with a liking for electrical work. The salaries paid are large—promotion rapid, and, best of all, the profession is not overcrowded.

The International Correspondence Schools of Scranton can make *you* an expert in the line of electrical work you like best. Hundreds of boys have already won success through I. C. S. help. *You* can do the same. Everything is made so clear that you can learn in your spare time, regardless of where you live or what you do. No books to buy. See your parents about it—they want you to succeed.

There's big money in electricity. Get after it by marking and mailing the attached coupon *to-day*. Finding out costs you nothing.

INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 1102 SCRANTON, PA.
Explain, without further obligation on my part, how I can qualify for the position before which I mark X.

Automobile Running	Civil Service
Mine Superintendent	Architect
Mine Foreman	Chemist
Plumbing, Steam Fitting	Languages
Concrete Construction	Commercial English
Civil Engineer	Building Contractor
Textile Manufacturing	Industrial Designing
Stationary Engineer	Commercial Illustrating
Telephone Expert	Window Trimming
Mechan. Engineer	Show Card Writing
Mechanical Draftsman	Advertising Man
Architectural Draftsman	Stenographer
Electrical Engineer	Bookkeeper
Elec. Lighting Supt.	Poultry Farming

Name _____
Present Occupation _____
Street and No. _____
City _____ State _____

Square Deal Miller
DIAMONDS WATCHES JEWELRY
On Easy Monthly Payments

TERMS SMASHED
On Waltham, Elgin, Howard, Hamilton Watches. The very finest made. No matter where you live YOUR CREDIT IS GOOD. Lower prices than all cash houses. Write for Big Free Catalog and great Credit Plan.
SQUARE DEAL MILLER, Pres., Miller Hoefer Co.
89 MILLER BLDG., DETROIT, MICH.
Canadian Branch, Windsor, Ontario, Canada

Ten Days' Free Trial
allowed on every bicycle we sell. We **Ship on Approval and trial** to anyone in the U. S. and *prepay the freight.* If you are not satisfied with the bicycle after using it ten days, ship it back and *don't pay a cent.*
FACTORY PRICES *Do not buy* a bicycle or a pair of tires from *anyone* at *any price* until you receive our latest **Art Catalogs** of high grade bicycles and sundries and learn our *astonishing new special offers.*
IT ONLY COSTS a cent to write a postal and everything will be sent you **FREE** by return mail. You will get much valuable information. **Do Not Wait;** write it **Now!**
TIRES, Coaster-Brake rear wheels, lamps, parts, repairs and sundries of all kinds *at half usual prices.*
MEAD CYCLE CO., DEPT. T-109 CHICAGO

Be Your OWN BOSS
AGENTS EARN BIG MONEY
selling **Golden Rule** genuine hand forged English Razor steel Knives. We will put any photo or lodge emblem on one side of the transparent handle, and name and address on the other. **We have a complete, fully guaranteed line of knives, razors, strops,** and **cutlery specialties.** Quick sales. Big profits. **Experience unnecessary. Write today for catalog and terms.**
GOLDEN RULE CUTLERY CO., 553 W. Lake St., Dept. 53, Chicago

STOP! LOOK! LISTEN!
Our lamps produce a brilliant, steady, white light at one fifth the expense of any other medium; suitable for all places and all purposes, easily installed, generator instantly interchangeable. Exclusive territory to responsible parties. **Free Illustrated Catalogue mailed on request.**
DOUD LIGHTING CO., 132 N. Sangamon St., CHICAGO, ILL., U.S.A.

AUTOMATIC TELEPHONE
—The one logical phone. 10-second secret connections—no delays, no wrong numbers—low in cost—local and long distance. Automatic service is blanketing Chicago. *For details phone or write*
ILLINOIS TELEPHONE & TELEGRAPH CO.
162 WEST MONROE ST., CHICAGO, Coml. Dept. 33-111

ONE DOLLAR A MONTH
Buys a Standard Typewriter

Your choice, Remington, Oliver, Smith Premier, L. C. Smith or Underwood. Prices lower than other cash prices. Perfect machines only. Guaranteed.
Typewriter Installment Co.
Dept. 9., 180 N. Dearborn St. Chicago

LET ME READ YOUR CHARACTER
from your handwriting. Mind you get a really **GOOD** reading that will help you in love, health, business and domestic affairs. Price **10c.** Sure to please you. **Money back if dissatisfied.** N. G. BEAUCHAMP 2583 8th Ave. New York City

INVENTORS We manufacture METAL SPECIALTIES of all kinds, to order; largest equipment; lowest prices. Send perfect sample for low estimate and best expert advice **FREE**
THE EAGLE MFG. COMPANY, DEPT .C. CINCINNATI, O.

For our Mutual Advantage mention Popular Electricity when writing to Advertisers.

DO YOU WANT MONEY?

THEN LISTEN! You can have it if you will send a postal card to us at once. We will put you in your own, quick-paying business where you will make $5 to $20 a day. You can do it just the same as our other men. Here are some late reports; Cable of Wyo., writes: **"Made $27.00 in 2 hours."** Bryant of Colo., **made $16.00 in 6 hours.** Evans of Miss., says: **"Made $15.75 last Tuesday."** Ferry, of Ky., **"Made $50.00 in 2 days."** Hundreds of actual, bona fide letters like these on file.

Now is your chance to get out of the "time clock" line and the "pay envelope" brigade. **Be a one minute photographer.** New business—tremendous opportunities—the world for your field—travel or at home—all or spare time—big, quick, clean profits at private houses, parties, picnics, on the street, in the small towns, in great cities, at fairs, carnivals, conventions, reunions; street parades, aviation meets, etc. etc.,—NO EXPERIENCE NEEDED—profits begin at once—first day—first minute—and you **Make 500% on Every Sale.** Don't delay—don't wait—act—**write at once** for complete free information about

The "Mandel" Post Card Machine

New invention—wonderful machine that takes, finishes and delivers five different styles of photos. Turns out original post card photos (also button pictures) at the rate of three a minute RIGHT ON THE SPOT WHERE YOU TAKE THEM. Wonderful, new, photographic process—startling—sensational—

Photos Direct on Post Cards

Without Plates, Films, Printing or Dark Room

Machine is everything in one—**a complete, portable post card gallery.** Excites interest, arrests attention, compels immediate orders from every onlooker. SMALL CAPITAL STARTS YOU. Sale of supplies that come to you with outfit practically gives you back entire investment—and you have the business clear and fully established. You begin making money the same day the outfit arrives. Immediate sales—immediate profits. If you are sincere and really want to make $2,000 this year—DO NOT DELAY—show us that you are in earnest—that you mean business. We will show you how to get the money. **Write now—at once. Information is FREE. Address either office**

THE CHICAGO FERROTYPE CO.

486 Ferrotype Bldg., Chicago, Ill. or **Dept. 486, Public Bank Bldg, New York**

Any Electrical Book on the Market

Can be obtained through our Book Department. Tell us your wants

POPULAR ELECTRICITY PUBLISHING CO.
54 West Lake Street, Chicago, Illinois

$200 A MONTH

BE YOUR OWN BOSS

If you are making less than $50 a week you should write us to-day. We can help you to wealth and independence by our plan. You can work when you please, where you please, always have money and the means of making barrels more of it **How would you like to** start out from home on a combined business and pleasure trip, stay at the best hotels, and live like a lord and clean up $10 every day. Work at amusement places, crowded street corners, manufacturing institutions, anywhere and everywhere, ten minutes' walk from home or on the other side of the globe. Just set a machine up any place you happen to select, and clean up $10 above operating expenses each and every day.

PAPER POST CARDS DIRECT

My proposition is the WONDERFUL NEW COMBINATION CAMERA, with which you can take and instantaneously develop eleven entirely different styles of pictures including Buttons, four styles and sizes of Paper Post Cards and six styles of Tintype Pictures. Every plate is developed without the use of films or negatives, and is ready to deliver to your customer in less than a minute after making the exposure. This REMARKABLE INVENTION takes 100 pictures an hour. Everybody wants pictures and each sale you make advertises your business and makes more sales for you

NO EXPERIENCE NEEDED

Simple instructions accompany each Outfit and you can begin to make money in fifteen minutes after the outfit reaches you.

A trifling investment will get this WONDERFUL OUTFIT for you and put you in a position to make $2,500 a year. If you want to be independent, and absolutely your own boss, write me to-day and I will send you by return mail, full free information regarding this WONDERFUL PROPOSITION including letters offering positive proofs from every part of the world. DON'T DELAY, ANSWER THIS ANNOUNCEMENT TO-DAY.

L. Lascelle, Mgr., 627 W. 43d St., Dept. 848, New York, U.S.A.

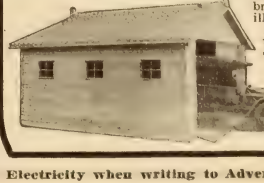
$92.50—Our Price for Next 30 Days

We now offer the Edwards "Steelcote" Garage (1913 Model), direct-from-factory, for $92.50. But to protect ourselves from advancing prices of steel, we set a time limit upon the offer. We guarantee this record price for 30 days only. Just now we can save you $35 or more.

Edwards Fireproof Steel Garage

Quickly Set Up Any Place

An artistic, fireproof steel structure for private use. Gives absolute protection from sneak thieves, joy riders, fire, lightning, accident, carelessness, etc. Saves $20 to $30 monthly in garage rent. Saves, *time, work, worry, and trouble.* Comes ready to set up. All parts cut and fitted. Simple, complete directions furnished. Absolutely rust-proof. Joints and seams permanently tight. Practically indestructible. Locks securely. Ample room for largest car and all equipment. Made by one of the largest makers of *portable* fire-proof buildings. Prompt, safe delivery and satisfaction guaranteed.



Postal sent today brings new 56-page illustrated Garage Book *by return mail.* Address

The Edwards Mfg. Co.
726-776 Eggleston Avenue, Cincinnati, Ohio

For our Mutual Advantage mention Popular Electricity when writing to Advertisers.

General Agents

Capable of calling on the big trade themselves and handling canvassers for the house to house and office to office business, to sell the newest electric specialty on the market; sold everywhere there is electricity—in the home, office, factory, store, hotel; liberal profits; sales-driving sample, weighs a pound; no experience or knowledge of electricity required; shows how to use one light instead of two and get the same results.

Sells for $2.50, $3.50, $5.00 and saves the purchaser an investment of $25.00. Write for particulars.

THE HANDY LIGHT CO.
266 Handy Light Blk., Cincinnati, O.

REDUCES ELECTRIC BILLS.
NO EXPERIENCE NECESSARY.
DOUBLES ILLUMINATION.
NO WORK TO INSTALL.

The Latest On

House Wiring

By **THOMAS W. POPPE**
ELECTRICAL ENGINEER AND CONTRACTOR

Absolutely new and up to the minute, describing and illustrating all up-to-date methods of installing Electric Light Wiring according to the latest rulings of the National Board of Fire Underwriters. All systems of wiring are covered, including the three-wire system now so much in use. Practical diagrams and illustrations are given to show just how the work is done.

It Solves All Problems

FOR THE PRACTICAL WIREMAN OR AMATEUR

and in fact contains all the essential information for the successful wiring of a building.

Among the subjects covered are—Planning and laying out the work — Locating the Meter — Meter Connections—Feed Wires—Switches—Plug Receptacles—Brackets—Ceiling Fixtures — Flexible Conduit System—Rigid Conduit System—Steel Armored Cable System — Knob and Tube System — Various Switching arrangements explained and diagramed—The easiest method of testing Three and Four-way circuits explained and illustrated—Current carrying capacity of Wires—Etc.

103 Pages, 74 Illus. **Flexible Cloth Cover, Pocket Size**

PRICE, FIFTY CENTS POSTPAID
Money refunded if not satisfactory

POPULAR ELECTRICITY BOOK DEPARTMENT
54 W. Lake St., Chicago, Ill.

Will Not Burn Out

An important feature of these motors is that they will not heat under any circumstances 1/12 and ¼ H. P. for A.C. and D.C. Finished in Black Enamel.

THE
BARNES
Variable Speed and Reversible

Are especially adapted for Washing Machines, Printing Presses, Coffee Mills, Dental Apparatus, Vacuum Cleaners, Wireless Apparatus, etc.

Let us figure on your requirements

BARNES MFG. CO. 107 Belmont Street Susquehanna, Pa.

LIMITED NUMBER

1/15 H.P. High Speed 110 Volt Motors

A. C. or D. C. No base or cover. 2⅝ in. diameter. 6½ in. long. 3¾ pounds.

Built For Business **$5.00** Delivered Not Toys

Great Bargain. Ad. will not appear again.

NOW—TODAY is the time to order.

The Carleton Company **178 Summer St., BOSTON**

TESTED APPARATUS

MEANS THE ELIMINATION OF FAULTS IN YOUR PRODUCT

Electrical and photometrical tests of every description. Checking electrical instruments of all kinds and classes. Inspecting and testing new electrical machinery, apparatus and material at factories and after installation. Tests on any electrical machinery and apparatus made anywhere. Arc and incandescent lamp tests, either electric, gas, acetylene or oil. Illumination tests made anywhere. Secondary standards of candle-power furnished. Facilities furnished to experimenters and investigators.

We have recently added to the above, Coal Testing, and are now prepared to make proximate analyses and calorific determinations on samples of coal, promptly and accurately.

ELECTRICAL TESTING LABORATORIES

80TH STREET AND EAST END AVENUE NEW YORK, N. Y.

For our Mutual Advantage mention Popular Electricity when writing to Advertisers.

Use this remarkable HEALTH BATTERY *Ten days FREE*

Electricity will give you vigorous health! Electricity will give you *power, vitality*—all the exhilarating joys of *life!* Physicians use electricity constantly. *You* can have all the remarkable benefits of expensive treatments in the privacy of your home at a cost so small as to be negligible.

The Ind-Electric

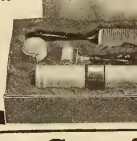
Health Battery with complete attachments for body, face and scalp massage **all for $5.00,** offers you every advantage of complicated machines costing several times as much. We even go further than this. We ask you to *prove* our claims for yourself. Use the *Ind-Electric 10 days FREE.* Try it out in every way before you decide.

We *know* you will like it. Thousands of people have bought just this way. Ten minutes' use will prove its *wonderful value.* Write us *at once.* Start *right away* getting the advantages of these *free electrical treatments.*

Send now for FREE Book
"Beauty and Health"

IND-ELECTRIC MFG. CO.
Desk M, 432 Peoples Gas Bldg.
CHICAGO, ILL.

Agents make $50.00 to $100.00 a week selling the Ind-Electric. Write for territory.



How to Stop Snoring

Use Dr. Page's remarkable Snore-Mute and you can't snore. You won't humiliate yourself. You won't annoy others. Simplest device ever perfected on scientific principles. Stop snoring and restore normal breathing while sleeping. Light as a feather, small, simple and antiseptic. Get one and stop snoring. Worn with comfort and pleasure. Carry it in your card case when traveling or visiting.

BOOKLET SENT FREE

Don't embarrass yourself and annoy others any longer. Get a Snore-Mute and sleep without snoring. Send only 25c today and get your Snore-Mute. Your money back if you are not delighted. Booklet sent free. Send for free booklet anyway. Send today.

DR. C. S. PAGE CO., Dept. 5457, Ironwood, Mich.

"HUMAN INTEREST STUFF"

Big guns out on the coast are trained on a distant target at night by a searchlight; someone sent us a photograph and short description and we bought it at once. Near Los Angeles there is an old, old tree, a government land mark, and a new trolley line was made to take a curve to get around it—we bought another photograph and a couple of hundred words readily. Someone conceived the idea of treating chickens with high frequency current to make them grow faster, and when photographs and description were sent us we were only too glad to accept them. These are examples of what is known in journalism as "human interest stuff." We want more and more of it for the magazine. We want every subscriber to be a human interest scout. Good rates are paid for acceptable material—which must be hinged in some way on electricity. Send for our little pamphlet "What to Write and How to Write It."

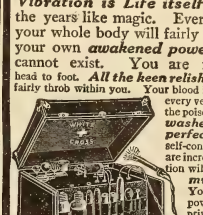
POPULAR ELECTRICITY MAGAZINE
54 W. LAKE ST., CHICAGO, ILL.
Editorial Department

POWER for YOU!

Power from within! Strength that is *more* than mere muscular strength—the strength of perfect health, abundant nerve force—now within your own reach through *Vibration!* Nine people out of every ten are only ***half alive!*** Are you? Listen—

All the Exhilarating Joys of Life-Strength-Youth

may be returned to you through ***Vibration. For Vibration is Life itself.*** It will chase away the years like magic. Every nerve, every fibre in your whole body will fairly tingle with the force of your own ***awakened power!*** Stagnation simply cannot exist. You are made over new from head to foot. ***All the keen relish, the pleasures of youth,*** fairly throb within you. Your blood is sent humming along through every vein, artery and tiny capillary. All the poisonous matters in your system are ***washed away.*** Every organ is put in ***perfect working order.*** Your self-confidence—***your self-respect*** are increased a hundred fold. Yes, Vibration will do all this, and more, ***much more.*** And it is within your reach. You can enjoy its wonder-working powers right at home, right in the privacy of your own room. You can give yourself the same identical treatments which you would receive in the offices of the world's most famous specialists—all without extra charge.



The White Cross Electric Vibrator

Is the result of years of work and experiment. It is absolutely perfect. If you have your house wired for electricity, you can connect it up as easily as an electric lamp; if not, it will run perfectly on its own batteries.

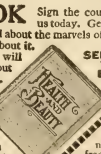
Special Offer for a Limited Time

For a short time only we are making a remarkable Special Introductory Offer on the White Cross Electric Vibrator—amazing discounts—actual rock-bottom prices direct ***if you act at once.***

FREE BOOK

FREE book telling you all about the marvels of ***Vibration.*** Read what scientistssay about it. Post yourself on what it will do for you. Learn all about the ***White Cross Electric Vibrator*** and our limited offer. You are under no obligations at all—all you need to do is to send the coupon ***today***—you can send a postal card or a letter, but the coupon will do just as well.

Sign the coupon and mail it to us today. Get our splendid big



SEND FOR THIS BOOK

Lindstrom, Smith Co.
218 S. Wabash Av
Desk 1404
Chicago, Illinois

Without any obligations on my part, please send me, free and prepaid, your free book on Vibration, full particulars of the White Cross Vibrator and your Special 60-Day Offer.

Name .....

Address .....

WRITE PLAINLY

Lindstrom-Smith Co.
218 S. Wabash Av.
Desk 1404
Chicago, Ill.

THOR ELECTRIC
Made for an Easy Wash Day

Wash Day Becomes Easy Day

WHEN YOU PUT A

Thor Electric Laundry Machine

In Your Home, and for Only $1.50 a Week —$6.50 a Month—You Can Soon Own One

Eliminates the drudgery and back-breaking labor, washes the heaviest blankets or daintiest laces spotlessly clean, without injury, and without any hand rubbing. Does the entire week's washing and wringing for the average family in 90 minutes at a cost of 3c. for electricity.

Our dealer in your city will deliver a machine to you, or we will ship to you direct for a

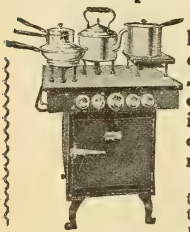
15 Days' Free Trial

We make electric washing machines from $30.00 up. Write for our Catalogue F today.

HURLEY MACHINE COMPANY

NEW YORK, 1011 Flatiron Building **CHICAGO, 27 S. Clinton Street**

Why Be Old Fashioned At the Expense of Comfort?



The kitchen or laundry properly equipped with *Simplex Electric* cooking and heating appliances is as comfortable as any room in the house.

The dining room with the Simplex electric toaster, chafing dish, percolator, table range, etc., becomes the most delightful place in the world.

Simplex Electric heating appliances make *such* a difference. No dirt, delay or bother.

Thousands are sold from coast to coast by good dealers and electric light stations.

Fully described in our catalog F-17.

SIMPLEX ELECTRIC HEATING CO.

Cambridge, Mass. **15 So. Desplaines St., Chicago**
612 Howard St., San Francisco **Belleville, Ontario**

SIMPLEX EQUALITY

A 30 Day Free Trial

in your home will demonstrate to your satisfaction how necessary the

SIMPLEX IRONER

is for economical management.

It saves your strength, **health, beauty,** time and money. It irons five times as **fast, better** and makes it **easier.** Servants are better contented, more efficient. Heats by gas or electricity. Operates by hand or small motor at small expense. It really costs nothing because it saves its cost every six months. Write for booklet and "Ironing Hints." Both free.

AMERICAN IRONING MACHINE COMPANY
55 East Lake Street **Chicago, Ill.**

THE CADILLAC ELECTRIC VACUUM CLEANER

Possesses everything that is essential to make it the best Vacuum Cleaner on the market. Light, weighs only 8 lbs. Made entirely of aluminum. Strongest suction, easiest running. Equipped with General Electric Co. motor. *FULLY GUARANTEED.*

OVER 35,000 CADILLACS IN DAILY USE

$30.00

COMPLETE WITH HARDWOOD FLOOR TOOL

Has brush in the nozzle to pick up lint, threads and hair, has rollers allowing it to run easy over the carpets and rugs. Your home is not complete unless you have a CADILLAC ELECTRIC VACUUM CLEANER. Saves babies' and mothers' health.

CLEMENTS MFG. CO.

427-441 West Randolph Street CHICAGO, ILL.

$30.00 with floor tool, **$38.00** complete with 9 foot of covered hose and 6 TOOLS for cleaning everything in the home. F. O. B. Chicago. If there is no dealer in your city write to us direct for catalog.

Also manufacturers of Cadillac Hand Power Vacuum Sweepers

LIVE DEALERS WANTED

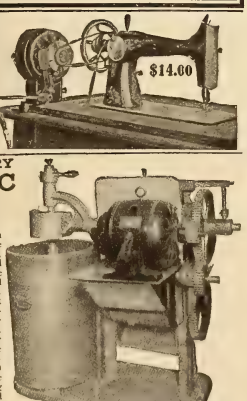
SEWING MACHINE ELECTRIC MOTOR

Anyone can attach it to machine. Simple and durable. $14.00 alternating or direct.

FIDELITY ELECTRIC COMPANY
Lancaster, Pa.

The DEWSBERRY
ELECTRIC ICE CREAM FREEZER

Our power freezer is an ice-cream factory complete in itself; having the crusher, freezer tub and motor all mounted on one base plate that occupies but a small amount of floor space. Nothing but the very best of material and workmanship enter into these machines, and are built unusually substantial; for this reason we guarantee that they will give satisfaction. Made in 4, 6, 8, 20 and 40 quart sizes and are equipped with alternating current, variable speed motors. Write today for circular.



R.A. DEWSBERRY, 1014 W. Lake St., Chicago, Ill.

Isn't There Something You'd Like to Know About Lighting Fixtures?

Our "Service Department" is maintained especially for dealers and consumers who have a lighting problem to solve.

Whether you are interested in buying lighting fixtures for a new home, or installing one or two new patterns in place of some old style, inefficient design, this department will be glad to help you—and all their services are free.

We're especially anxious right now to send you a new booklet about lighting fixtures that will look well in your home.

Light and Art in the Home

is a 16-page booklet that tells what the lighting requirements of a modern home are, and how to select fixtures designed to give harmony of decoration and healthful illumination.

Write us for a copy today.
It will be sent you by the next mail.

Beardslee Chandelier Manufacturing Co.

227 S. Clinton St. CHICAGO

"The House of Quality"

Trade (B) Mark

J-M Electrotherm

Takes the Place of the Hot Water Bottle

It consists of a thin, light and flexible sheet or pad containing wires insulated and protected with Asbestos. When attached to an ordinary incandescent lamp socket, it offers sufficient resistance to the current to produce a constant and uniform degree of heat. It is provided with a regulating switch by means of which three different temperatures can be obtained.

Made for any voltage from 7 to 125 volts and can be used with either direct or alternating current. Indispensable in treating such diseases as pneumonia, neuralgia, bronchial affections, rheumatism, etc. Made regularly in blankets, collars, caps, chest and back pads, mats for operating table, sweating jackets, etc.

WRITE NEAREST BRANCH FOR ILLUSTRATED BOOKLET

H.W. Johns-Manville Co.

Manufacturers of Asbestos and Magnesia Products

ASBESTOS

Asbestos Roofings, Packings, Electrical Supplies, Etc.

Albany	Chicago	Detroit	Louisville	New York	San Francisco
Baltimore	Cincinnati	Indianapolis	Milwaukee	Omaha	Seattle
Boston	Cleveland	Kansas City	Minneapolis	Philadelphia	St. Louis
Buffalo	Dallas	Los Angeles	New Orleans	Pittsburgh	Syracuse

The PIONEER and PEER of them ALL

Why Pay Exorbitant Prices

for complicated, insanitary wooden washing machines, if you can buy a practical and everlasting All-Metal

Sanitary Paragon Power Washer

for operation by electric or gas motor

AT A TREMENDOUS SAVING IN PRICE

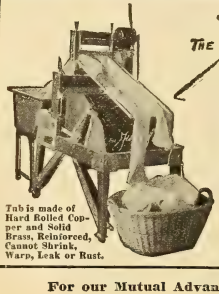
PRICES range from $23.75 to $150.00. Three sizes.

OVER 100,000 PARAGONS USED IN THE U. S.,

the most convincing *proof* of *unequalled superiority*. *Before* wasting your money in buying inferior makes send for our interesting catalog No. 2 and further details of the *most liberal proposition* ever made by any manufacturer. *Established 1902.*

NO WOOD SANITARY METAL ONLY

PARAGON MFG. CO., 2403-05 W. 14th St., CHICAGO



Tub is made of Hard Rolled Copper and Solid Brass, Reinforced, Cannot Shrink, Warp, Leak or Rust.

THE Judd

Won't Wear Out the Clothes

The Reason Why ?

It's Perfectly Smooth Inside

Blankets and finest fabrics are all the same to THE JUDD, for the water is forced through the clothes a hundred times per minute. Ten or fifteen minutes will thoroughly cleanse a tub full.

Two hours to do a family washing! The electricity from any light socket will do the work at a cost of about four cents.

The special motor operates the reversible wringer and washer at the same time.

Let us show you how THE JUDD works.
Descriptive literature for the asking.

JUDD LAUNDRY MACHINE COMPANY

Room 335 People's Gas Building, CHICAGO

2c a Week Pays Wash Bill!

Write for FREE Book

Electricity or Water-Power Does the Work

Just a "Twist of the Wrist" Starts or Stops the Machine!

The 1900 Motor Washers are now at work in thousands of homes. They are doing the work formerly done by women, **at a cost of 2c a week for power!** Saving thousands upon thousands of dollars in wash bills. Saving worlds of wash-day troubles. Leaving the women free to do other work while the machines are doing the washing.

The 1900 Motor Washer

1900 Water Motor Washer Can be connected with any water tap instantly

Washes a Tubful in Six Minutes!

Handles Heavy Blankets or Dainty Laces

The outfit consists of the famous 1900 Washer with either Electric Motor or Water Motor. You turn on the power as easily as you turn on the light, and back and forth goes the tub, washing the clothes for dear life. Then, turn a lever, and the washer does the wringing. All so simple and easy that it is mere child's play.

Doing the wringling with 1900 Electric Motor Washer

A Self-Working Wringer Sent With Every Washer!

The motor runs Washer and Wringer. We guarantee the perfect working of both. No extra charge for Wringer, which is one of the finest made. Write for **FREE BOOK** and 30 Days' **FREE TRIAL OFFER!** Don't doubt! Don't say it can't be done. The free book proves that it can. But we do not ask you to take our word for it. We offer to send a 1900 MOTOR WASHER on absolute Free Trial for an entire month to any responsible person. Not a cent of security—nor a promise to buy. Just your word that you will give it a test. We even agree to pay the freight, and will take it back if it fails to do all we claim for it. A postal card with your name and address sent to us today will bring you the book free by return mail. All correspondence should be addressed to

1900 WASHER COMPANY
6046 COURT STREET, BINGHAMTON, N. Y.

Or, if you live in Canada, write to the Canadian Washer Co., 355 Yonge St., Toronto, Canada.

SAVE

YOUR HEALTH
YOUR GOOD LOOKS
YOUR TIME
YOUR CLOTHES
YOUR MONEY

All Metal Springless Tub

DON'T grow prematurely old and haggard over a back-breaking washboard and a side-ache producing wringer, when there is a better and far cheaper way to wash your clothes

DOMESTIC ELECTRIC WASHER and WRINGER

5 cents worth of electricity and 2 hours time will wash your clothes clean—make them look better and wear longer.

Enclosed Working Parts **Easily Cleaned**

15 Days' Free Trial in Your Own Laundry. Send for Catalogue and Easy Payment Plan.

DOMESTIC EQUIPMENT CO.
Dept. P. 30 W. Lake St., Chicago

AFTER A SHAMPOO

Dry the Hair Quickly with a

PELOUZE ELECTRIC COMB AND CURLING IRON

Acts as a tonic for the hair and scalp—makes the hair luxuriant—saves time and labor—works perfectly. To use Curling Iron—simply remove the comb—makes beautiful lasting waves or curls. The heater and cord revolve together, so that the cord does not kink while in use. The temperature is so regulated in the heater that it can't burn the hair.

No.	THREE STYLES	Price
542	Electric Comb complete	$8.75
532	Electric Curling Iron only,	3.50
552	Curling Iron and Comb complete	4.50

If your dealer hasn't it we pay expressage on receipt of price.

PELOUZE MFG. CO.
232-242 E. Ohio St., CHICAGO

THE AUTOMATIC ELECTRIC WASHER

Is represented to be a very high class machine. We claim that it does the work just a little more satisfactorily than any other electric washer; that it is better made than any other electric washer; that more attention is paid to all details and conveniences; that it is a better looking, better selling and better operating machine than any other electric washer; that the control is simpler and more absolute and the results more satisfactory. We make these and stronger representations in our printed matter. And we further say to you that if you will order the AUTOMATIC ELECTRIC WASHER, and upon its arrival examine it thoroughly and test it exhaustively, and find that it is not even better than we have represented it to be, then you are at liberty to return it at our expense. *Do you realize that this is a business proposition?*

Ask for Bulletin 88.

Automatic Electric Washer Co.
Newton, Iowa

AutoMatic Washer MADE IN NEWTON IOWA

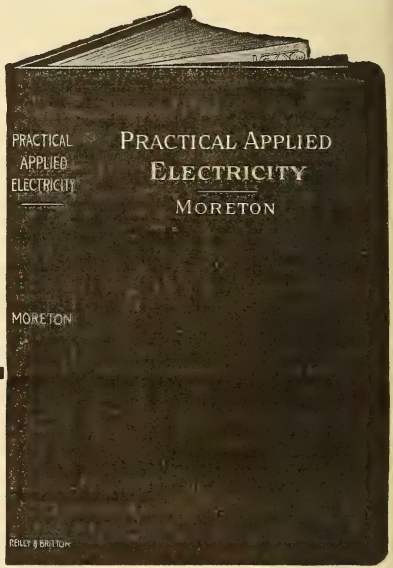
For our Mutual Advantage mention Popular Electricity when writing to Advertisers.

A Complete Course in Applied Electricity

Practical Applied Electricity

By DAVID PENN MORETON, B. S. E. E.

Covering every line of electrical work as taught in the Armour Institute of Technology, an institution of world wide fame.



Practical Applied Electricity is the outgrowth of actual work combined with classroom experience. The author is Associate Professor of Electrical Engineering at the Armour Institute of Technology. Most of the students taking the electrical course attend the evening classes, being employed at electrical work through the day. The problems which confront these students are embodied in this book—one reason for its being so practical and up-to-date. To illustrate this valuable information, careful detailed drawings have been made under the personal supervision of the author. In plain words, this book contains the experience of a large number of ambitious electrical workers, gathered together by a recognized authority on the subject.

CONTENTS:

The Electrical Circuit and Electrical Terms Explained by Means of the Water Analogy; Ohm's Law; Series and Divided Circuits; Calculation of the Resistance of Various Circuits and Conductors; Primary Batteries; Dry and Wet Cells; Voltage; Internal Resistance and Polarization; How to Renew; Series and Parallel Connections; Tables of Data of Commercial Types of Cells; Magnetism; Permanent Magnets; Electromagnets; The Magnetic Circuit and Quantities Involved; Magnetic Properties of Various Materials; Magnetic Calculations; Instruments; Construction of Various Types of Ammeters, Voltmeters, Wattmeters, Galvonmeters, etc.; Calibration of Instruments; The Dynamo; Fundamental Principle; The Magnetic Field; Commutation; Armature Reaction; Characteristics of the Series, Shunt and Compound Types of Generators; Motors, Fundamental Principle; Various Types and Their Application to Different Kinds of Work; Motor Speed Control; Variable Speed Motors; Railway Motors, Elevator Motors, etc.; Storage Battery; Fundamental Principle; Commercial Types; Application; Care of; Systems of Power Distribution; Two and Three Wires; Balancers; Motor Generator Sets, etc.; Practical Operation of Electrical Machinery; Connections in Series and Parallel; Motor and Generator Troubles, How to Locate and Remedy Them; Electrical Lighting; Various Types of Incandescent and Arc Lamps, Application of Various Types; Photometry of Lamps; The Nernst Lamp; Moore Tube; Mercury Vapor Lamp; Electrical Wiring; Calculation of Conductors; How to do Exposed Moulding and Conduit Work; How to Install and Connect Heaters, Motors, Generators, Fixtures, Arc Lamps, etc.; Wiring Tables for Different Classes of Work; Alternating Current Circuit; Comparison of the Direct and Alternating Current Circuits; Quantities Involved; Series and Divided Circuits; Measurements of Power; Alternating Current Generators and Motors; Resuscitation; Numerous Miscellaneous Reference Tables.

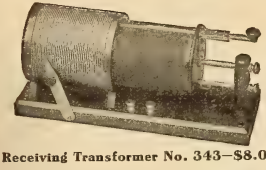
The language is so plain, and the mathematics so simple that no one can fail to understand. Questions and answers given at the end of each chapter, impress upon the mind of the reader the more important points to be remembered.

450 PAGES 323 ILLUSTRATIONS BLACK FLEXIBLE LEATHER BINDING

Price $2.00 Postpaid

All interested in electricity, old or young--artisan or amateur--expert or experimenter--should own this absolute authority. Money refunded if you are not satisfied.

POPULAR ELECTRICITY BOOK DEPT., 54 W. Lake St., Chicago, Ill.



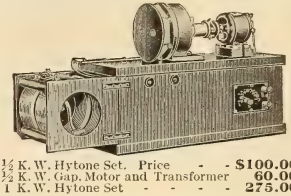
Receiving Transformer No. 343—$8.00

A Sharp Wave

such as that which must be radiated under the provisions of the wireless law may be efficiently tuned only by circuits containing an efficient tuning device. The receiving transformer illustrated here is the best working instrument ever offered at such a low price. It will perform every required tuning operation with efficiency equal to any instrument on the market at double the cost.

Wm. J. Murdock Co.
50 Carter Street
CHELSEA, MASS.
480 Folsom Street, San Francisco

THE HYTONE
Rotary Gap Quenched Spark Transmitting Set



½ K. W. Hytone Set. Price - - $100.00
½ K. W. Gap, Motor and Transformer 60.00
1 K. W. Hytone Set - - - - 275.00

Duplicates the shrill piercing tone characteristic of 500 cycle sets but operates on 60 cycle A. C. and is practically noiseless in operation. Have you ever stopped to consider why the quenched spark has been adopted exclusively by all modern commercial and government stations?

Has twice the efficiency of standard spark sets, and complies in all respects to the new Federal Radio Regulation Act.

We reiterate, you are not up-to-date if you are not on our mailing list; 4c in stamps will place you there and bring our latest literature at once.

CLAPP-EASTHAM COMPANY
141 Main St., Cambridge, Mass.

Aylsworth Agencies Co.
143 Second Street
San Francisco, Cal.
Western Sales Agents

J. J. Duck
430 St. Clair Street
Toledo, Ohio.
Central States Agent

Send for Copy of Our New Wireless Manual E1

It contains 96 pages and tells how to erect and maintain wireless telegraph stations. Shows a number of diagrams. Has the Morse and Continental Telegraph Codes. Illustrates the best instruments to use; tells what they are for and how to use them. Do not wait until some other time, but sit down now and send your name and address, and get one. It costs you nothing

Send for Our Pocket Catalog E26

It contains 212 pages, with over 1,000 illustrations, and describes in plain, clear language all about **Bells, Push Buttons, Batteries, Telephone and Telegraph Material, Electric Toys, Burglar and Fire Alarm Contrivances, Electric Call Bells, Electric Alarm Clocks, Medical Batteries, Motor Boat Horns, Electrically Heated Apparatus, Battery Connectors, Switches, Battery Gauges, Wireless Telegraph Instruments, Ignition Supplies, Etc.**

It Means Money Saved to You to Have Our Manual and Our Catalog When You Want to Buy

MANHATTAN ELECTRICAL SUPPLY COMPANY
NEW YORK, 17 Park Place CHICAGO, 114 So. 5th Ave. ST. LOUIS, 1106 Pine St.

DUCK'S BIG 325 PAGE ELECTRICAL & WIRELESS CATALOG

CELEBRATED FERRON DETECTOR

It yet remains the peer of all Detectors licensed for private use. Price only **$5.** The Ferron Detector contains the same high grade crystal and an adjustment equally as admirable as the Pyron Detector licensed for commercial use which sells for $65.00. License for private use permit of low price.

A patron of Greenville, Michigan, voluntarily writes:—With your Ferron Detector I received the larger Atlantic Coast stations (700 to 800 miles) and have heard Key West very clearly (1500 miles) all over land.

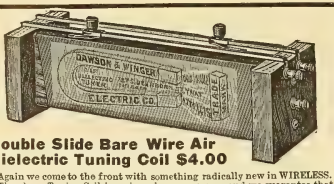
Mailed for 6c. stamps or coin, which you may deduct on first order of $1.00. Great cost of catalog and low prices prohibit distribution except to those really interested. **Save 25% to 33⅓% on Standard Electrical Goods by getting this big Catalog.** There is no catalog to take its place; neither will you find elsewhere as large a variety of standard electrical goods at such attractive prices.

WHAT OUR BIG CATALOG CONTAINS:

100 pp. Wireless Instruments for Experimental and Commercial use. (Wireless section four times as large as the majority of wireless catalogues. It contains over thirty diagrams showing how to connect all combinations of instruments.) 1 pc. Telegraph Instruments of same quality as used by Western Union and Postal Companies. 40 pp. Toy and Commercial Motors. 20 pp. Flash Lights and Miniature Lamps, and 145 pp. of Home Lighting Plants, Mechanical Tools, Guns, Pocket Knives, Miniature Railways, and Electrical Supplies.

THE J. J. DUCK COMPANY, 393-395 St. Clair St., TOLEDO, OHIO

For our Mutual Advantage mention Popular Electricity when writing to Advertisers.



Double Slide Bare Wire Air Dielectric Tuning Coil $4.00

Again we come to the front with something radically new in WIRELESS. The above Tuning Coil is unique in many ways, and we guarantee that with all other things being equal, it will bring in signals louder and clearer than any other Double Slide Tuner manufactured, regardless of price.

We have gotten away from the supposedly necessary cylindrical form of core, and in so doing are enabled to air space the turns of wire from each other. The only points of actual contact of the turns with a common support are the four edges of the quadrilateral winding and these supports are of vulcanized Hard Rubber, so practically 95 per cent. of the total length of the wire is air spaced, thus reducing the chance of leakage to a minimum. Price $4.00, express charges to be paid by consignee at destination.

The above Tuner equipped with an extra slide, thus making a Triple Slide Tuner, price $4.50. The size of the bare copper wire is either No. 22 or 24 as you may select, prices being the same in either instance

We are agents for the "BRANDES" Long Distance Receivers now so well and favorably known that detailed description is unnecessary.

"BRANDES" SUPERIOR TYPE, 2000 Ohms total, per pair postpaid, $5.20
"BRANDES" TRANS-ATLANTIC TYPE, 2800 Ohms total, per pair postpaid, $9.20
"BRANDES" IMPROVED NAVY TYPE, 3200 Ohms total, per pair postpaid, $13.20

The above receivers are fully guaranteed, each and every phone having the name "BRANDES" plainly stamped on the aluminum case; Head bands are Hard Rubber covered in the instance of the U. S. Army and Navy and solid German Silver for the "SUPERIOR" type. Cords are green silk 6 ft. in length.

Single "BRANDES" SUPERIOR Phone, 1000 Ohms, postpaid, $1.60
Single "BRANDES" SUPERIOR Phone, 1000 Ohms, with leather covered head band and single cord, postpaid, $2.65

Promptness in delivery is our specialty; a large stock of phones always on hand. Send stamp for descriptive circular of Tuners together with some of our other specialities.

DAWSON & WINGER ELECTRIC COMPANY
727 South Dearborn Street Chicago, Illinois

Wireless Course Free

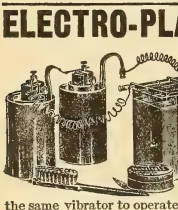
20 Lessons. From 1 to 20.

With each purchase of $1.00 worth of our wireless material we give you a lesson free.

Western Agents For
THE ELECTRO IMPORTING CO.
Same Catalog. Same Prices.
Send 4c in stamps for catalog

ANDERSON LIGHT & SPECIALTY CO.
134 N. La Salle St., Chicago, Ill.
Opposite City Hall.

ELECTRO-PLATING OUTFIT



Our complete electro-plating outfit as above will be sent to any address express collect for $8.45. Wireless Novelties and Electrical Supplies of every description. Send stamp for our catalogue. The following is our "special." An electrical massage vibrator to operate on 110-125 A. C. or D. C. for $14.00, the same vibrator to operate on dry cells $14.00. Receivers 2000 ohms complete with headband for $3.65. Minerals of every description also Electro-Surgical Instruments.

DETROIT ELECTRICAL SPECIALTY CO.
Department Erskine DETROIT, MICH.
SEND STAMP FOR CATALOGUE

JUST READY! 4th Edition Revised and greatly enlarged

BOUND IN CLOTH $1.15 Postpaid
Nearly 300 pages, 176 Illustrations.

SPON & CHAMBERLAIN, 123 P. E. Liberty St. NEW YORK

REX MOTOR

Neat in design and well made—a great favorite with the boys. Runs efficiently on one cell, dry or other battery. Finished in black enamel; screws and other trimmings nickel plated. Polished wood base, packed in a neat box, size 3 x 3½ x 3½ inches, properly labeled. Weight about 12 ounces. Sent on receipt of price, **$1.00.** Postage 11 cents extra.

Special Offer For a limited time only we will send this motor prepaid absolutely free with a trial subscription to **Modern Electrics, An Authority on Wireless.** Every live boy should take at least one semi-technical electrical magazine and keep up-to-date on the new wonders and advances in electricity; Modern Electrics illustrates and describes these subjects in a style that can be read and understood by you. It is nearly five years old and contains from 112 to 144 pages monthly. 15 cents per copy; $1.50 per year. Tells you how to make things at home; contains an experimental department and answers your questions free.

Send $1.50 today in cash, stamps or M. O. and get **Modern Electrics** for one year and we will send you the Motor prepaid **Absolutely Free.**

Modern Electrics
262 Fulton Street
New York, N. Y.

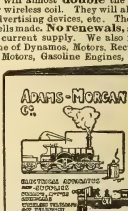
MODERN ELECTRICS

Boy Electrician with 75 illustrations for making Batteries, Dynamos, Motors, Telegraph apparatus, Telephone, Lights, Bells, Alarms, Coils, "Wireless" Current Reverser, Electric Engine, Etc. By Electrical Experts so that anyone can understand it. With Cat. All **10c Ppd.**
J. C. DORN, 709 So. Dearborn St., Dept. 49, Chicago, Ill.

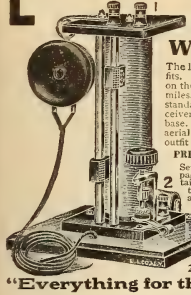
10 Amp.-Hour Storage Cell Price $1.00 A set of these wonderful batteries will almost **double** the transmitting range of your wireless coil. They will also run toy motors, lamps, advertising devices, etc. The most reliable and durable cells made. **No renewals,** simply recharge from direct current supply. We also manufacture a complete line of Dynamos, Motors, Rectifiers, Transformers, Water Motors, Gasoline Engines, Model Aeroplanes, etc. We sell complete sets of materials for building Loose Couplers, Induction Coils, Motors, Dynamos, Variable Condensers, etc.

We manufacture the largest line of reliable amateur Wireless apparatus in the world. With every **Wireless Catalogue** we give a complete list of all the Wireless Telegraph Stations, Battleships, Steamships, etc., together with their **CALL LETTERS. Over 1,400 in all.** It is **FREE** for 4 cents in stamps to cover the cost of mailing. Same may be deducted from the first order. A new edition has just been issued. Send now.

ADAMS-MORGAN CO.
"The Experimenter's Supply House"
Box 72a Upper Montclair, N. J.



LISTEN TO THE WIRELESS



The Interstate Wireless Outfit

The latest word in Wireless Receiving outfits. The most compact little outfit ever put on the market. Receives messages over 400 miles. Comprises double slide tuning coil, standard detector, 75 ohm Telephone Receiver, battery, all mounted on heavy oak base. Size 6"x6"x9". Weight 3½ lbs. Attach aerial wire to post 1, ground to post 2 and outfit is ready to receive.

PRICE Complete as Described, $3.75

Send today 4c postage for our famous 220-page electrical encyclopedia No. 11, containing 480 illustrations and over 1500 electrical articles, information on wireless and electrical subjects. ASK FOR OUR FREE TREATISE ON WIRELESS TELEGRAPHY.

THE ELECTRO IMPORTING CO.
233 B FULTON ST., NEW YORK.

"Everything for the Experimenter"

DROP US A POST CARD
for our book, catalog and pamphlet, *"18 Ways to Make Money."* They are Free.
POPULAR ELECTRICITY MAGAZINE, Book Dept.

KNIFE SWITCHES FOR WIRELESS

Many other Electrical and Wireless Specialties

No. 301—20 P. P. 1 lb. Rate — Catalogue Postage 3c.

JOHN Y. PARKE & CO.
Dept. A — 127 N. 7th Street, PHILADELPHIA

Wayne Bell Transformers

Displace unreliable, troublesome batteries and use practically no current. Operates door bells, buzzers, toys, etc. Made in three sizes for different classes of work and can be connected to any A. C. Lamp socket.

SEND FOR LEAFLET 4511

FORT WAYNE ELECTRIC WORKS
of General Electric Company
1603 Broadway — Fort Wayne, Ind.

BOYS—EXPERIMENTERS

POST PAID $2.00 A scientifically perfect model motor, having a laminated drum armature, self-adjusting brushes, etc. Finished in black japan and nickel. Space occupied, 3¼x 3½x3¾ inches.

Send stamp for catalog

HEINDELL MOTOR CO.
Dept. 10, 425 Crescent Ave., BUFFALO, N. Y.

Brandes Transatlantic Type
2800 OHMS

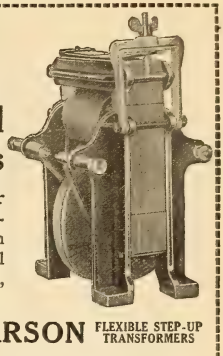
The best low priced long distance receiver made. The ball and swivel arrangement on our receivers, with hard rubber headband and their light weight make them the most perfect fitting, sanitary and comfortable headset made.

We send our receivers on trial for comparison. Write us.

COMPLETE SET WITH SIX FOOT CORD **$9.00**

C. BRANDES, Inc., 111-115 Broadway, New York

Every Wireless Fan Should Know This



The transformer is the most important factor in every successful wireless station, small or large.

THORDARSON FLEXIBLE STEP-UP TRANSFORMERS

are perfect in every detail. Endorsed by wireless experts. Power varied instantly by simple turn of thumbscrew. Equipped with magnetic shunt. Connect direct to any A. C. circuit—no impedance coils or other resistances needed. Two standard types—10,000 and 20,000 volts capacity. Special windings to order. Best on the market—most economical.

Write for Circular and Prices Today

THORDARSON ELECTRIC MFG. CO.
505 S. Jefferson Street, Chicago, Ill.

OSCILLATION TRANSFORMER

This Loose-Coupled Helix is built especially to meet the requirements of the new regulations. By varying the distance between Primary and Secondary, it will give any degree of Coupling, and allows very sharp tuning. The Secondary can be set at any point on the central rod, and is held in place by a clamping device at the top. Is built on thoroughly seasoned, varnished Mahogany wood; insulation perfect. We have prepared ourselves for the demand there will be for this Instrument, and can make shipment immediately upon receipt of order. No. 912 for use on from 2-inch Coils up to ½ K. W. Price, $5.50. No. 914 from ½ to 1 K. W. Price, $8.00. Positively 5 cents in stamps for 1913 Illustrated Catalog.

F. B. CHAMBERS & CO., 217 N. Ninth St., Philadelphia, Pa.

ORDER THIS BOOK

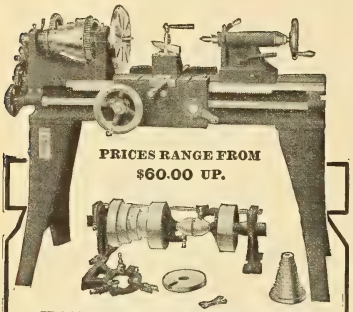
HOW TO READ WIRELESS

messages sent in the continental code. A wonderfully simple method every amateur should know about and practice. With it you can become expert in a very short time. Read all the news flying through the air. Price 25 cents. Don't miss this opportunity. Order to-day at special introductory price.

Send 10c at once for Book P. I.

HUNT & McCREE 92 MURRAY STREET NEW YORK

For our Mutual Advantage mention Popular Electricity when writing to Advertisers.



PRICES RANGE FROM
$60.00 UP.

BUILT FOR SERVICE

Made to Satisfy Expert Mechanics

Buy One of Our Lathes and Be Ready for the Man With the Profitable Lathe Job.

Wise and economical buyers order all their machinery from us. GET IN LINE and add one more to the big procession of successful and satisfied buyers.

Write for Machinery Catalog 83P50, FREE

WE SELL THE BEST MACHINERY AT THE LOWEST POSSIBLE PRICES.

Buy a Guaranteed Accurate Lathe for Your Work.

WE MAKE NO SHIPMENTS OUTSIDE THE LIMITS OF THE UNITED STATES

Address **SEARS, ROEBUCK AND CO., CHICAGO**

An Automatic Boring Tool that Fits Your Pocket

This is a mighty handy, convenient tool. It is compact and when compressed can be carried in the pocket. But set it to work and you'll find it has all the good qualities of larger—and more expensive borers.

Star Borer No. 8

has cells in the handle holding eight drill points ranging in size from 1-16 inch to 11-64 inch, and numbered from 1 to 8. Cell No. 9 contains a small screwdriver to be used when the tool is compressed, with the plunger forced back into the handle and held there.

The price of this Auto Pocket Borer is **$2.00.** Look for the name—MILLERS FALLS. *Our book "Tool Practice" is FREE—send for it.* **MILLERS FALLS CO., 28 Warren St., New York City**

Dies, Tools and Special Machinery

Designers and Manufacturers

Model and experimental work confidential. Exclusive manufacturers of Accident Insurance Co. Policy Vending machines, also the McCaleb Adding and Listing Machine.

THE METAL NOVELTY CO. **St. Louis**
1131 S. BROADWAY

Building Contractor Agents

Wanted to use and help sell the

Rapid Floor SCRAPER

One man scrapes more floor than three by hand. Get our Free Catalog.

FREE TRIAL

MONARCH MFG. CO.
753 Shepard Bldg.
Grand Rapids, Michigan

We Ship on Approval

without a cent deposit, prepay the freight and allow **10 DAYS FREE TRIAL** on every bicycle. **IT ONLY COSTS** one cent to learn our *unheard of prices* and *marvelous offers* on highest grade 1913 models.

FACTORY PRICES a pair of **tires** from *anyone at any price* until you write for our new large **Art Catalog** and learn our *wonderful proposition* on the first sample bicycle going to your town.

RIDER AGENTS everywhere are making big money exhibiting and selling our bicycles. **We Sell** cheaper than any other factory.

TIRES, Coaster-Brake rear wheels, lamps, repairs and sundries at *half usual prices.* **Do Not Wait;** write *today* for our *latest special offer* on "Ranger" bicycle.

MEAD CYCLE CO. **Dept. T-109 CHICAGO**

CATALOG FREE

SOUTH BEND
LATHES
$75

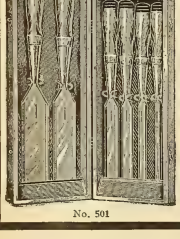
Screw Cutting Foot Power, Steam Power or Electric Motor Drive 9 to 13 In.

South Bend Machine Tool Co.
427 Madison St., South Bend, Ind

FOOT AND POWER LATHES, PLANERS

Drill Presses, Shapers and Gear Cutters, First Class Tools at Low Prices Especially for Garages. *Write for catalog*

SHEPARD LATHE CO.
209 E. Sixth St. Cincinnati, O.

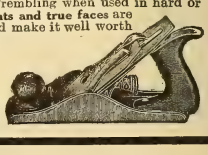


No. 501

"OHIO" CHISELS are made from **high grade and specially selected tool steel,** and the care, skill and experience of our 89 years in the Edge Tool business is put into every tool bearing our "Ohio" Trade Mark shown here. The result is a **high grade and very satisfying tool, with a keen, tough and lasting cutting edge.**

REGISTERED

"OHIO" PLANES are fitted with our special Extra Heavy Cutter, which prevents Chattering or Trembling when used in hard or knotty timber. **High grade cutters, accurate adjustments and true faces** are only a few of the points in which our planes excel and make it well worth your while to insist on having them from your dealer.



Write for our free Catalogue of High Grade Tools and Benches.

OHIO TOOL CO., (Dept. 12)
COLUMBUS, OHIO

For our Mutual Advantage mention Popular Electricity when writing to Advertisers.

"YANKEE" TOOLS
Make Better Mechanics

"YANKEE" Ratchet Hand Drill

No. 1530. Price, $2.80

Length, 10½ in.
Weight, 1¼ lbs.

5 Adjustments:
Plain Drill
Left-hand
Right-hand
Double Ratchet
Locked

Three-jaw chuck; capacity, 3-16 in.

Magazine for drills in handle of tool.

These five adjustments are controlled by the Shifter on cylinder, as indicated, and changes are made at a finger-touch.

The "YANKEE" **Double Ratchet** permits of speedy work in tight places—any motion of the crank, forward or back, no matter how slight, causes the drill to cut continuously.

Your dealer can supply you

Free Tool Books—*Mechanics and householders, write for "'Yankee' Tool Book." AUTOMOBILISTS, write for "'Yankee' Tools in the Garage."*

NORTH BROS. MFG. CO., Philadelphia

THE ORIGINAL AND GENUINE

KLEIN TOOLS just keep in order as a matter of course. It's in the nature of them, and, there is a tool for any of your needs shown in the Klein catalogue.

If you are a tool user send for it. *Since 1857* Klein Tools have practically wired the earth. Pretty good proof of their worth, isn't it?

Mathias Klein & Sons
Canal Station 3, Chicago, Ill.

SAY

If you only knew how handy THIS "RED DEVIL" IS you would never be without it. RED DEVIL Chain Drill No. 2012, automatic feed, ball bearing, fitted with our Universal chuck, taking round or square shank drills ⅛ to ⅜. If you use a brace and bit for drilling, improve the method. Use a RED DEVIL chain drill and note the results.

All dealers sell them. Ask and insist on RED DEVIL No. 2012. If not on sale locally, send us $2.20 and one only will be sent you prepaid.

SMITH & HEMENWAY CO. 105 Chambers St. New York, U.S.A.
(If you are tired cutting wire, use a Red Devil Plier—it bites)

P. S. & W. TOOLS
TRADE MARK
GUARANTEED

REG. U. S. PAT. OFF.

The largest line of guaranteed box-joint pliers on the market

A full line of lap-joint pliers and splicing-clamps

"The MARK of the MAKER"
is put on all guaranteed P. S. & W. Pliers

But our best guarantee is the invariable satisfaction of expert electricians everywhere.

Write for the "Mechanics' Handy List," a 170-page book including 35 pages of reference tables and useful information, and over 200 tools for Electricians, Machinists, Carpenters and Tinsmiths.

The Peck, Stow & Wilcox Co.

MFRS. of the Largest Line of Mechanics' Hand Tools Offered by Any Maker.

SOUTHINGTON, CONN. NEW YORK, N. Y.
CLEVELAND, OHIO

Address correspondence, 30 Murray Street, New York City

Build Your Own Boat

The Frame We Ship You

from our patterns or knock down frames. You save ¾ the cost and enjoy the work. Patterns and frames for boats of all types and sizes, from the canoe pattern at $1.75 to the 65 ft. yacht frame at $350, and a full line of heavy built commercial boat frames.

SEND FOR OUR CATALOG

which tells you all about it. You can build a 20 ft. launch for $30 from patterns, that you could not buy at any factory for less than $150, or you can buy the complete frame and build this 50 ft. cruiser shown in the picture for less money than you would have to pay for the cheapest 25 ft. finished cruiser you could buy.

The Boat You Build

DEFOE BOAT & MOTOR WKS., 3211 State St., Bay City, Mich.

SEND FOR MOTOR CYCLE CATALOGUE

Three great Pope features

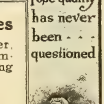
Overhead-valve motor—more power. Rear Spring Suspension insures comfort without retarding speed. Spring fork absorbs vibration

Model H	"Lightweight"	$165
Model K	"The Big 4"	$200
Model M	"5 h.p."	$215
Model L	"Twin"	$250

Get the details. Write today.

THE POPE MANUFACTURING COMPANY
524 Capitol Ave., Hartford, Conn.
Makers of Pope Bicycles. Catalog Free

Pope quality has never been - - - questioned



POPE
MOTOR CYCLES

GRAY MOTORS FOR BOATS

Largest Builders of 2-cycle Motors in the World. Over 1000 responsible dealers.

3 H.P. with Complete Outfit ready to install **$55**
ALSO 4&5TO 36 HP

Guaranteed by a big responsible concern. Write for big catalog—*tells* and *shows* you all about these high grade motors and how they are made.

GRAY MOTOR CO., 494 Gray Motor Bldg., Detroit, Mich.

Best grade cedar canoe for $20
Detroit canoes can't sink

All canoes cedar and copper fastened. We make all sizes and styles, also power canoes. Write for free catalog, giving prices with retailer's profit cut out. We are the largest manufacturers of canoes in the world.

DETROIT BOAT CO., 48 Bellevue Ave., Detroit, Mich.

GAS ENERGY

A newsy, reliable monthly for all interested in any kind of gas or gasoline engine. One valuable feature, a comprehensive review, monthly, of all new patents, described and illustrated. 50c a year.

GAS ENERGY COMPANY
26 Murray Street - - - New York City

FREE—If you send in your order right away, mentioning this magazine, we will mail you gratis a copy of "How to Run and Install Gasoline Engines."

RIDER AGENTS WANTED
in each town to ride and exhibit sample 1913 model. *Write for Special Offer.* Finest **$10 to $27** Guaranteed 1913 Models with Coaster-Brakes and Puncture-Proof Tires. 1911 and 1912 MODELS **$7 to $12** ALL OF BEST MAKES..... **100 Second-Hand Wheels** *All makes and models, good as new* **$3 to $8** Great Factory Clearing Sale. We **Ship on Approval** *without a cent deposit, pay the freight* & allow **10 Days' Free Trial** **TIRES** coaster-brake wheels, lamps, and sundries, *half usual prices.* DO NOT BUY till you get our catalogue and offer. *Write now.*
MEAD CYCLE CO. Dept. T-109 CHICAGO

BUILD YOURSELF A BOAT
A RACING CAT OR SPEED LAUNCH
Send for Catalogue
Yacht and Boat Building Books
RUDDER PUBLISHING CO., 2 Hudson St., New York, N. Y.

2H.P. **$45** Complete Ready to Run

Turn Your Row Boat into a Launch
This simple, compact, reliable little AMERICAN engine will do it. Easy to install—easy to operate. Just the thing for fishing, hunting or summer home use. Price covers engine complete with shafting, propeller, etc. Send for catalog. Shows complete line from 2 to 30 h.p.
Complete 16-foot AMERICAN Launch Seats 7 to 9 people. Send for details **$125**
American Engine Co., 461 Boston St., Detroit, Mich.

GET THIS CATALOG
FULL OF VALUABLE INFORMATION TO EVERY BOAT OWNER ON
RACING PROPELLER WHEELS, REVERSE GEARS AND MARINE ACCESSORIES
LARGE CATALOG FREE. SEND TODAY
MICHIGAN WHEEL CO.
1151 MONROE AVE., GRAND RAPIDS, MICH

MULLINS STEEL BOATS CAN'T SINK

Built like Government Torpedo Boats, of tough, puncture-proof, galvanized steel plates, so securely joined together that a leak is impossible. The Mullins Steel Boat is *guaranteed* against puncture, leaking, waterlogging, warping, drying out, opening seams, etc. MOTORS: The Lozier 4-Cycle and Ferro 2-Cycle. Light, powerful, simple, can be operated by the beginner, start like automobile motors, one man control, never stall at any speed, exhaust silently under water. *Beautiful illustrated book, free.*
THE W. H. MULLINS CO., World's Largest Boat Builders, 193 Franklin St., Salem, Ohio

STEEL ROW BOATS AND CEDAR CANOES

Magnificent Steel Launch $96
Complete With Engine, Ready to Run

18-20-25 and 27 ft. boats at proportionate prices. All launches tested and fitted with Detroit two-cycle reversible engines with speed controlling lever—simplest engine made—starts without cranking—has only 3 moving parts—anyone can run it. **The Safe Launch**—absolutely non-sinkable—needs no boathouse. All boats fitted with air-tight compartments—cannot sink, leak or rust. We are sole owners of the patents for the manufacture of rolled steel, lock-seamed steel boats. Orders filled the day they are received. Boats shipped to every part of the world. **Free Catalog Steel Rowboats, $20.** (83)
MICHIGAN STEEL BOAT CO., 1366 Jefferson Avenue, Detroit, Mich., U. S. A.

Electric Light For Your Home

no matter where located supplied at low cost with a Fairbanks-Morse Lighting Plant. Engine runs on kerosene or gasoline; uses little fuel.

Prepare for Summer

Choose the safe, cool, sanitary light—electricity. You can then enjoy the convenience of electric fans, washers, cooking appliances, etc.

Engine can also be used for pumping, churning, running water system, cream separator or other light machinery. Everything furnished complete. *Ask for Catalogue 1163M2.*

Fairbanks, Morse & Co.,
900 S. Wabash Avenue Chicago

Manufacturers of Oil and Gasoline Engines, Water Systems and Electric Motors

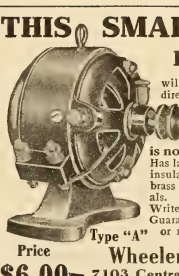
FACTORY PRICES YOURS

60 DAY FREE TRIAL

The famous WITTE Gasoline Engine, built for 43 years by Ed. Witte, master engine builder, now sold **direct to you.** The standard engine of America, with every improvement up-to-date—detached cylinders, vertical valves, etc.—the entire engine backed up by a **Real 5-Year Guarantee.** Just think! It takes only **2c to get the money-saving, factory prices on 54 styles and sizes.** Save money! Write at once for **FREE TRIAL OFFER** and catalog. State style and size wanted. Address

WITTE IRON WORKS CO.
2227 Oakland Avenue, Kansas City, Mo.

THIS SMALL 110 VOLT POWER MOTOR



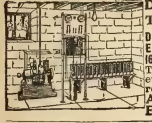
will operate on either alternating or direct current, consumes less current than a 16 c. p. lamp and can be attached to any lamp socket. Built for commercial purposes—absolutely will not run **hot** and **is not a toy.** Has laminated field and armature mica insulated commutator, bronze bearings, brass grease cups, pulley and terminals. Shipping weight, 4 lbs. Write today for our descriptive circular. Guaranteed to be entirely satisfactory or money refunded.

Type "A"

Price **$6.00**

Wheeler Electric Co. Not Inc.
7103 Central St. CHICAGO

ELECTRIC LIGHT AND POWER



DAY AND NIGHT SERVICE
The Junior No. 1 Equipment
Direct Connected Dynamo, Gasoline Engine Set. Complete Switchboard, (6-Cell "American" Storage Battery) The most complete, reliable equipment ever offered at this price. We want a representative in every county. $265

AMERICAN BATTERY COMPANY
Est. 1889 1143 Fulton St., CHICAGO

ELECTRIC LIGHTING PLANTS

Novelties, Specialties, Motion Picture Equipment, Home, Theatre, Farm, Factory, School and Town Lighting and Power Plants. Hunting, Fishing, Bicycle, Carriage, Automobile, Musicians, Necktie, Flash and Decorative Lights. Mazda and Flaming Arc Lamps. Massage, Ozone and Motion Picture Machines. Railways, Transformers, Telephones, Sewing Machine and Power Motors, Heating Pads, Laundry Irons, Lanterns, Hydro Electric Dynomos, Meters, Generators, Engines, Storage and Primary Batteries, Belts, Bells, Books. Fortune for Agents. Catalogue 3 cents.

OHIO ELECTRIC WORKS, Cleveland, Ohio

SMALL ENGINES

½ H. P. Up

Steam, Gas and Gasoline. For Amateurs and Mechanics. Circulars for stamp. Biz Catalogue Engines, Small Power Machinery and Electric Light Plants, 2 Lights Up. Sent for 10 cents (coin preferred.) Refunded first order.

AMATEUR MECHANICS SUPPLY CO.
860A Monadnock Block, Chicago, Illinois, U. S. A.

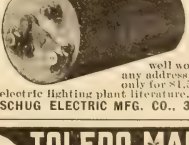
VACUUM PUMPS

For Powerful Portable and Stationary Vacuum Cleaning Plants. They take up their own wear. Powerful, Noiseless: can't get out of order.

GET CATALOG NO. 85

LEIMAN BROS., 62AD John St., NEW YORK

ELECTRIC MOTORS
SHOULD BE
"ROTHMOTORS"
Polishers, Grinders, Blowers
Write for Literature
ROTH BROS. & CO.
1385 W. ADAMS STREET, CHICAGO



THIS

is a cut of our latest experimental jump spark coil. It gives a spark ¼in. long with two dry cells, can be used for vibrators and many other purposes, and experimental work; it is very neat and compact, well worth $5.00. We will send it to any address in the U. S. A. for a short time only for $1.50 cash with order. Send for our electric lighting plant literature.

SCHUG ELECTRIC MFG. CO., 331 East Jeff St., Detroit, Mich.

TOLEDO MARINE MOTORS

Make boating a pleasure. You know there'll be no engine troubles to mar the trip. A marvel of smooth working simplicity that the most mechanical can easily understand and operate. Complete, 4 cycle, 2 port.

3 H. P. 1 cyl.	$65.00
4 H. P. 1 cyl.	80.00
6 H. P. 2 cyl.	150.00
8 H. P. 2 cyl.	180.00
15 H. P. 2 cyl.	250.00

3 1/2x4 1/2 Standard fittings. Anywhere. Write today for catalog.

THE UNIVERSAL MACHINE CO., 417 Bank St., Bowling Green, O.

The Only LAW Course

And Complete Law Library Ever Sent FREE On Approval

Any one ambitious to study law either as a profession or as a practical business aid should grasp this opportunity to investigate the greatest, most complete law course ever devised. Requesting these home study lessons to be sent on approval, for your examination, implies

No Obligation On Your Part

No one else can or dare duplicate this offer, because no other home-study law course can stand the acid test of being sent out on approval for careful examination without any obligations being imposed upon the person making the request. But we are so sure of the reception the La Salle Extension University Law Course will meet at the hands of any thoughtful, earnest person that we do not hesitate to make this wonderfully liberal "approval without obligation" offer which places the first lessons and complete set of law text books (14 volumes) of the La Salle Extension University Law Course in your hands—for *seven days* careful examination—without obligating you in any way whatever.

These Lessons Start You Right

They show you how to become a thoroughly competent lawyer—explain the requirements step by step in a plain, simple, direct way that will start you right and save you a lot of time, trouble and expense. The first lessons put you at once in the path followed by America's Foremost Lawyers—men who have themselves gone through such steps as they now recommend for you.

Mail Coupon Today for Our Wonderful Free Book

How To Study Law At Home

—under the World's Greatest Masters of Law—how to utilize your spare moments in preparing yourself for a great profession at very small cost—how to prepare for bar examinations in any State—how to increase your mental powers by training that will make you a leader in your community. If you contemplate studying law, you surely want to master the best course in the shortest time at least expense. So send for our wonderful free book and full particulars how you can examine this great course in your own home without risk, expense or obligation—and become thoroughly posted.

We are authorized by the State of Illinois to confer on our graduates the Degree of Bachelor of Law (LL.B.)

Save Half Your Tuition

We will also point out a way by which you can save half your tuition charges—so it will be just like keeping a lot of money in your own pocket, if you answer this promptly.

Mail Coupon Today for Full Particulars

SEND NO MONEY Just your name and address in letter, postal or on the Free Coupon below, will promptly bring our wonderful free book and full particulars of our remarkable approval offer by return mail. You will find this Guide to the Law an invaluable aid in putting you on the right track. Don't fail to send today.

How to Become a Lawyer

(Tear Off and Mail this Free Coupon Now)

La Salle Extension University, Dept. 42 Chicago, Ill.

Please send me your wonderful free book and full particulars regarding your approval without obligation offer and tell me how to save half on my tuition.

NAME.....

ADDRESS.....

OVER 67 YEARS' PRACTICE

PATENTS

TRADE-MARKS, DESIGNS, COPYRIGHTS, ETC.

Anyone sending a sketch and description may quickly ascertain our opinion free, whether an invention is probably patentable. Communications strictly confidential. Handbook on Patents sent free. Patents taken through Munn & Co. receive special notice, without charge, in the

SCIENTIFIC AMERICAN

A handsomely illustrated weekly. Largest circulation of any scientific journal. Terms, $3 a year; four months, $1. Sold by all newsdealers.

MUNN & CO. *367 Broadway, New York, and 625 F St., Washington, D. C.*

PATENTS

C. L. PARKER
Formerly Member Examining Corps, U. S. Patent Office.

PATENT LAWYERS
12 McGill Bldg., WASHINGTON, D. C.

Patents, Trade Marks, Copyrights, Patent Litigation

Handbook for Inventors, **"Protecting, Exploiting and Selling Inventions"** sent free upon request.

PATENTS

BRING WEALTH; PROOF BOOKS, ADVICE FREE. LOW RATES, EASY TERMS.

A. Dept. 99, Wederburn, Pat. Atty., Washington, D. C.

Central Station Managers

The current used by the average consumer on the books of one of our clients is more than twice that of five years ago. This class of business—increased consumption of current by present users—is particularly profitable as it can be secured without the expense of installing new lines.

¶ Scores of lighting companies, including those operating in

Denver	**Omaha**
Detroit	**Buffalo**
Philadelphia	**Cleveland**

and including towns of 4,000 to 1,600,000 are benefiting by the use of the Co-operative Advertising Service. The drawings are by the best commercial artists in the country, copy by experts on Central Station advertising, type-set by ad specialists.

A request on your business stationery will bring a book containing specimens of the advertisements supplied and full detail.

WM. D. McJUNKIN ADVERTISING AGENCY
35 South Dearborn Street CHICAGO

WANTED-IDEAS

Manufacturers are constantly writing me for new ideas

PROTECTED BY OWEN PATENTS

FREE! Send for the three finest patent books published and read their letters—see what they want! **"SUCCESSFUL PATENTS"**—tells how to proceed; **"STEPPING STONES"**—contains list of over 200 inventions wanted, the truth about prizes, etc.; **"PATENT PROMOTION"**—tells how to promote and sell your rights, chief causes of failure, etc. **A simple request will bring you all three books absolutely free.**

Personal Services. I help my clients sell their patents or dispose of their applications. Advice Free. No obligation incurred by writing me. Manufacturing facilities. I get you strong protection or receive no compensation.

VERY HIGHEST REFERENCES

Columbia National Bank, Washington, D. C.
American Loktile Co., Alexandria, Va.
National Metal Tile Co., Washington, D. C.
National Supply Co. Berlin, N. H.
Louden Machinery Co. Fairfield, Iowa.
Antholene Mfg. Co. Hutchinson, Kans.
Whitehead Hosiery Mills, Burlington, N. C.
Dickinson Mfg. Co., Des Moines, Iowa.
The Fancher Drug Co., Bridgeport, Ill.
The Starrett Mfg. Co., Shelbina, Mo.
The C. J. Loftus Co. Youngstown, O.
Lightening Gun and Cycle Works, Okla. City, Okla.

SPECIAL!

Send me a sketch or model of your invention and I will make a search of the U. S. Patent Office Records **FREE OF CHARGE** and report to you concerning patentability, practicability, etc.

And an immense number of others whose letters are printed in my booklets.

RICHARD B. OWEN, 6 OWEN BUILDING, WASHINGTON, D. C.

Inventors submitting their invention to me are protected in a tangible manner until their applications are filed.

PATENTS

TRADEMARKS AND COPYRIGHTS SECURED OR FEE RETURNED

Send model or sketch and description of your invention for *free* search of the U. S. Patent Office Record.

Our FOUR BOOKS mailed free to any address. Send for these books; the finest publications ever issued for free distribution.

HOW TO OBTAIN A PATENT. Our Illustrated 80 page Guide Book is an invaluable book of reference for inventors and 100 mechanical movements illustrated and described.

FORTUNES IN PATENTS. Tells how to invent for profit and gives history of successful inventions.

WHAT TO INVENT. Contains a valuable list of inventions wanted and suggestions concerning profitable fields of invention. Also information regarding prizes offered for inventions, among which is a **Prize of One Million Dollars** offered for one invention and $10,000 for others.

PATENTS THAT PAY. Contains letters from our clients who have built up profitable enterprises founded upon patents procured by us.

LIST OF PATENT BUYERS. Personal requests and letters from manufacturers and promoters for patents secured by us and suggestions of new ideas they wish to purchase.

We advertise our clients' inventions free in a list of Sunday newspapers with two million circulation and in the World's Progress. Sample copy free.

Electrical Cases a Specialty. We have secured many important electrical patents.

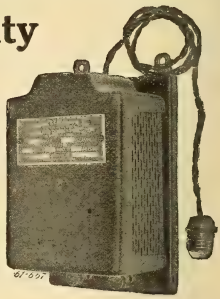
VICTOR J. EVANS & CO.

Victor Bldg., 724 9th St. N. W., WASHINGTON, D. C.

Home-Made Electricity

From Your Lighting Circuit

For Automobile Lighting



THE WAGNER RECTIFIER will charge your battery at home. Electric lights so supplied are cheaper to operate than gas or oil lamps.

Convert your gas and oil lamps to electric, easily and cheaply. Any wire-man can wire your car.

Write for Bulletin 933.

Wagner Quality

Wagner Electric Manufacturing Company, Saint Louis

The Importance of the Storage Battery in Electric Lighting Plants

The use of a battery provides a full 24-hour lighting service, usually impracticable on account of high expense when only an engine and generator are used.

A battery often overcomes the necessity of running an engine at night, as current for night lighting can be taken from the battery. It can be charged during the day while the engine is doing other work.

A battery provides ideal lighting, as it maintains a constant voltage, giving steady and even illumination.

Elevator or other motors can also be frequently operated by the battery during the night, overcoming the necessity of running an engine.

The most dependable battery for electric lighting and power service is

The "Chloride Accumulator"

This battery is composed of heavy lead plates assembled in glass jars so that the battery will have a long life and can be easily inspected and kept in good condition.

The "Chloride Accumulator" is the most widely used of all storage batteries. It is used by nearly all of the large Central Stations, Electric Railways, Western Union and Postal Telegraph Companies, the Bell Telephone Companies, U. S. Government, and in over 1000 isolated lighting and power plants. ***Write our office nearest you and secure our battery publications***

THE ELECTRIC STORAGE BATTERY CO.

1888 PHILADELPHIA, PA. 1913

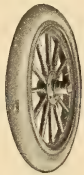
New York Boston Chicago St. Louis Cleveland Atlanta Denver
Detroit San Francisco Portland, Ore. Seattle Los Angeles Toronto

The "Exide" Battery is best for Ignition, Illumination or Self-Starters.

How to treble the mileage of your tires

Seventy-five per cent of tire expense comes from neglected casing cuts. Seal those cuts permanently; keep out dirt and water; and *your* tires will run until the tread rubber is *worn* through. Tires cared for this way don't blow out before they have given a third of the service of which they are capable. You always know that the fabric is sound—ready to give maximum service. You're relieved of the delay and exertion of changing tires when you go on a trip.

Going!



Going!!

Gone!!!

The Remedy!

SHALER Vulcanizers

make it possible for you or your chauffeur to use the approved method of making permanent tire repairs. They are the only vulcanizers that have the essential feature of a temperature control that is automatic, so that no skill or experience is required.

Shaler Vulcanizers mend tubes as well as casings. The new rubber is welded into the tire so that no amount of heat or wear will loosen it. Shaler-made repairs outwear the tire.

There are models for every requirement—prices $2.00 and up. Electric vulcanizers that heat from electric lighting current. Steam vulcanizers to use on the road or where electricity is inaccessible.

One copy of this book—FREE

We can still furnish a limited number of copies of the famous tire book "Care and Repair of Tires" postpaid to motorists who are interested. Write at once. Contains valuable repair kinks, descriptions of tire saving appliances, etc.

C. A. SHALER CO.

453 Fourth Street WAUPUN, WIS.

NATIONAL MAZDA

THE QUALITY LAMP

These Are the Lamps for Enlightened Homes

IF you want the electricity that goes through your meter to have a fair show you won't plug up its light-giving power with carbon lamps. You'll put a National Mazda lamp in every socket and get three times as much light at the same cost.

Comfort says, "Use National Mazda lamps for more light and better light."

Efficiency says, "Use National Mazda lamps for more light at the same cost."

Economy says, "Use National Mazda lamps and have all the light you pay for."

Convenience says, "Buy National Mazda lamps in the blue carton of 5 lamps and save a few trips to the store."

Prudence says, "Keep a carton of National Mazda lamps in the house against emergencies."

Everybody says, "Put a National Mazda lamp in every socket and have an enlightened home."

Thousands of Lighting Companies and Electric Stores sell National Mazda lamps. Look for the blue carton. Send for "The National Index to the Proper Lighting of Homes," free.

NATIONAL QUALITY LAMP DIVISION

of The General Electric Co.

4415 Hough Avenue, Cleveland

Any of these Labels is a guaranty of National Quality

For our Mutual Advantage mention Popular Electricity when writing to Advertisers.

Danger Lurks in Hidden Dust —Safeguard Your Family!

A *clean-looking* house may still be *insanitary*. That's the danger of sweeping with a broom. Shoes collect dried sputum from the sidewalks and deposit its dust on rugs and carpets. You can't see it, perhaps. But it's *there*. Then comes sweeping day. Your broom fills the air with invisible, germ-laden dust. It finds its way into your lungs—into your food—settles on the floor where playing children stir it up again and become infected. The *broom* is even more dangerous than the *fly*.

Federal Vacuum Cleaner

Sucks Up All the Germ-Laden Dust

No dirt too heavy—no dust too light and invisible to escape the FEDERAL Vacuum Cleaner. Its powerful suction searches every thread and fibre of rugs and carpets—clothing and drapery. Yet it can't injure the most delicate fabric. From the innermost depths of thick heavy padding, the powerful FEDERAL sucks out the dust and germ-laden air—making upholstery, pillows and mattresses as sweet and clean as new.

The FEDERAL is the Guaranteed Cleaner

But don't think that just any vacuum cleaner will do this. Some really do no more than a carpet sweeper. They pick up the *surface* dust—the *visible* dirt—but not the hidden, germ-laden dust. The Federal, which has no parts to wear out, like a *fan* device, a *bellows* or a *diaphragm*, creates a tremendously powerful suction. Constant use increases, not decreases, its power. The Federal is the machine that has stood the test of time.

The Powerful Rotary Pump

The Rotary Pump in the FEDERAL revolves steadily in one direction—like a powerful turbine engine on an ocean liner. It creates a suction impossible with a fan or bellows type of cleaner. Its working parts are few—simple—easy of access. No valves to work loose—no gears to rattle—no piston to pound up and down—no bellows to wear out—just a powerful, substantial pump and a motor—both revolving in one direction—steadily, silently, without jar or jerk.

Send for Illustrated Booklet, "Purity in the Home"

The Federal is not a cheap machine—price, $125—but it is the ***most economical*** cleaner to buy. We will gladly tell you why in our illustrated booklet, "Purity in the Home," No. 1453. Use the coupon ***now***.

Vacuum Cleaner Department

Federal Sign System (Electric)

Lake & Desplaines Sts., Chicago

SIGN, TEAR OFF AND MAIL

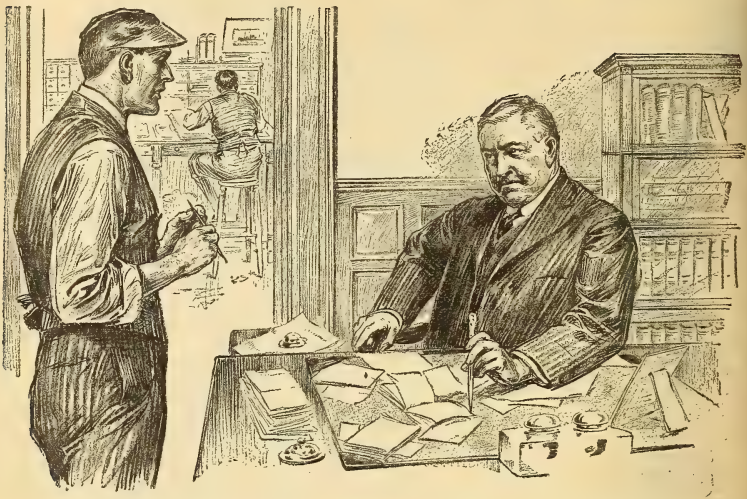
Federal Sign System
(Electric)
Lake & Desplaines Streets, Chicago, Ill.

Kindly send me your illustrated booklet, No. 1453, entitled, "Purity in the Home." It is understood that this places me under no obligations.

Name.....

Address.....

City.....



Striking the boss for a raise

Do you have to ***ask*** your employer for more pay? Do you find it necessary to call his attention to the fact that you are worth more money? Or are you a ***trained*** man—a man who receives frequent and unasked for increases in salary because the boss knows that your knowledge is valuable to him. There is no limit for the ***trained*** man—he is the employee who is pushed ahead—he's the chap that the well paying jobs seek. High wages and steady employment are always his, simply because he is too valuable to lose.

But the ***untrained*** man, plodding along at the same old salary year after year, has nothing in his favor but a record for faithfulness. He feels that his efforts are not appreciated—he doesn't realize that he is only a cog and can be replaced by any one of thousands of similar ***untrained*** men. He is a good employee, yet he has never made himself necessary to his employer's success. He's the sort of man who always has to ***ask*** for a raise.

Your Opportunity Coupon

Check the course you want and mail the coupon now

American School of Correspondence, Chicago, U. S. A.
Please send me your Bulletin and advise me how I can qualify for the position marked "X." Pop. Elect. 4.13.

....Electrical Engineering	....Lawyer
....Elec. Light & Power Supt.	....Bookkeeper
....Electrical Wireman	....Stenographer
....Telephone Expert	....Private Secretary
....Architect	....Accountant
....Building Contractor	....Cost Accountant
....Architectural Draftsman	....Certified Public Acc'nt
....Structural Engineer	....Auditor
....Concrete Engineer	....Business Manager
....Civil Engineer	....Fire Ins. Inspector
....Surveyor	....Fire Ins. Adjuster
....Mechanical Engineer	....Fire Ins. Expert
....Mechanical Draftsman	....Moving Picture Op'r
....Steam Engineer	....Sanitary Engineer
....Stationery Engineer	....Reclamation Eng'r
....Gas Engine Engineer	....Textile Boss
....Automobile Mechanician	....College Preparatory

NAME .....

ADDRESS .....

Become a trained man—get the money without asking

It is easy to get the training you need. You can do it in your spare time and in your home without giving up your work.

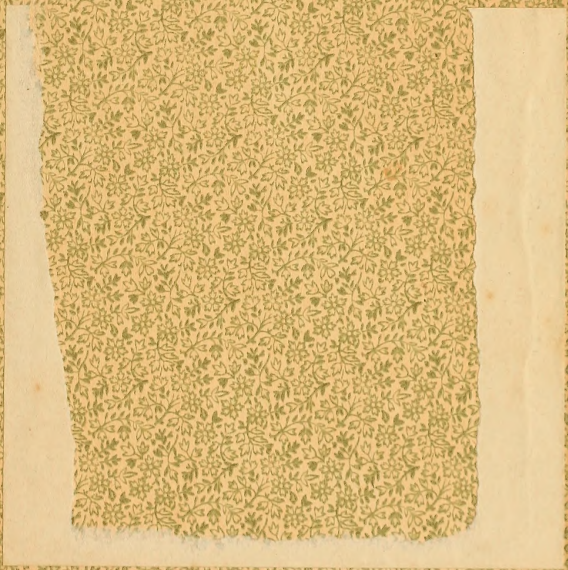
For fifteen years the ***American School of Correspondence*** has been preparing ambitious men everywhere for better jobs at bigger wages. The ***American School*** will give you the training you need, no matter where you live. It will train you in any branch of ***Engineering, Business and Law,*** or will prepare you for entrance into any resident college.

Perhaps you've never quite realized how easy it is to secure this training? Mark the coupon and let us explain to you how simple it is to prepare yourself for the position you want. We send no agents to bother you in your home or at your work. All business will be carried on by correspondence and our easy payment plan will allow you to pay as you progress.

Send the coupon today! Learn how to get a raise without asking

AMERICAN SCHOOL OF CORRESPONDENCE
CHICAGO, U. S. A.

This book may be kept **TWO WEEKS** from last date
A fine of TWO CENTS will be charged for each



SMITHSONIAN INSTITUTION LIBRARIES
3 9088 01548 8117